SR 87/SR 260/SR 377 CORRIDOR PROFILE STUDY

JUNCTION SR 202L TO JUNCTION I-40

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DRAFT WORKING PAPER 6: SOLUTION EVALUATION AND PRIORITIZATION

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PREPARED FOR:

ARIZONA DEPARTMENT OF TRANSPORTATION

PREPARED BY:

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ACRONYMNS & ABBREVIATIONS

ABBREVIATION	NAME
ADOT	Arizona Department of Transportation
CAG	Central Arizona Governments
CCTV	Closed Circuit Television
CPS	Corridor Profile Study
DMS	Dynamic Message Sign
FR	Forest Road
I	Interstate
IRI	International Roughness Index
LCCA	Life-Cycle Cost Analysis
MAG	Maricopa Association of Governments
MP	Milepost
MPD	Multimodal Planning Division
NACOG	Northern Arizona Council of Governments
NPV	Net Present Value
P2P	Planning-to-Programming
PES	Performance Effectiveness Score
PTI	Planning Time Index
PS	Prioritization Score
RWIS	Road Weather Information System
SR	State Route
SRPMIC	Salt River Pima Maricopa Indian Community
TTI	Travel Time Index
TPTI	Truck Planning Time Index
TTTI	Truck Travel Time Index
VMT	Vehicle-Miles Travelled

1.0 INTRODUCTION

The Arizona Department of Transportation (ADOT) is the lead agency for this Corridor Profile Study (CPS) of State Route 87 (SR 87)/State Route 260 (SR 260)/State Route 377 (SR 377) between Junction State Route 202L (Loop 202) and Junction Interstate 40 (I-40). This study examines key performance measures relative to the SR 87/SR 260/SR 377 corridor, and the results of this performance evaluation are used to identify potential strategic improvements. The intent of the corridor profile program, and of ADOT's Planning-to-Programming (P2P) process, is to conduct performance-based planning to identify areas of need and make the most efficient use of available funding to provide an efficient transportation network.

ADOT is conducting eleven CPS within three separate groupings.

The first three studies (Round 1) began in Spring 2014, and encompass:

- I-17: SR 101L to I-40
- I-19: Nogales to I-10
- I-40: California State Line to I-17

The second round (Round 2) of studies, initiated in Spring 2015, includes:

- I-8: California State Line to I-10
- I-40: I-17 to the New Mexico State Line
- SR 95: I-8 to I-40

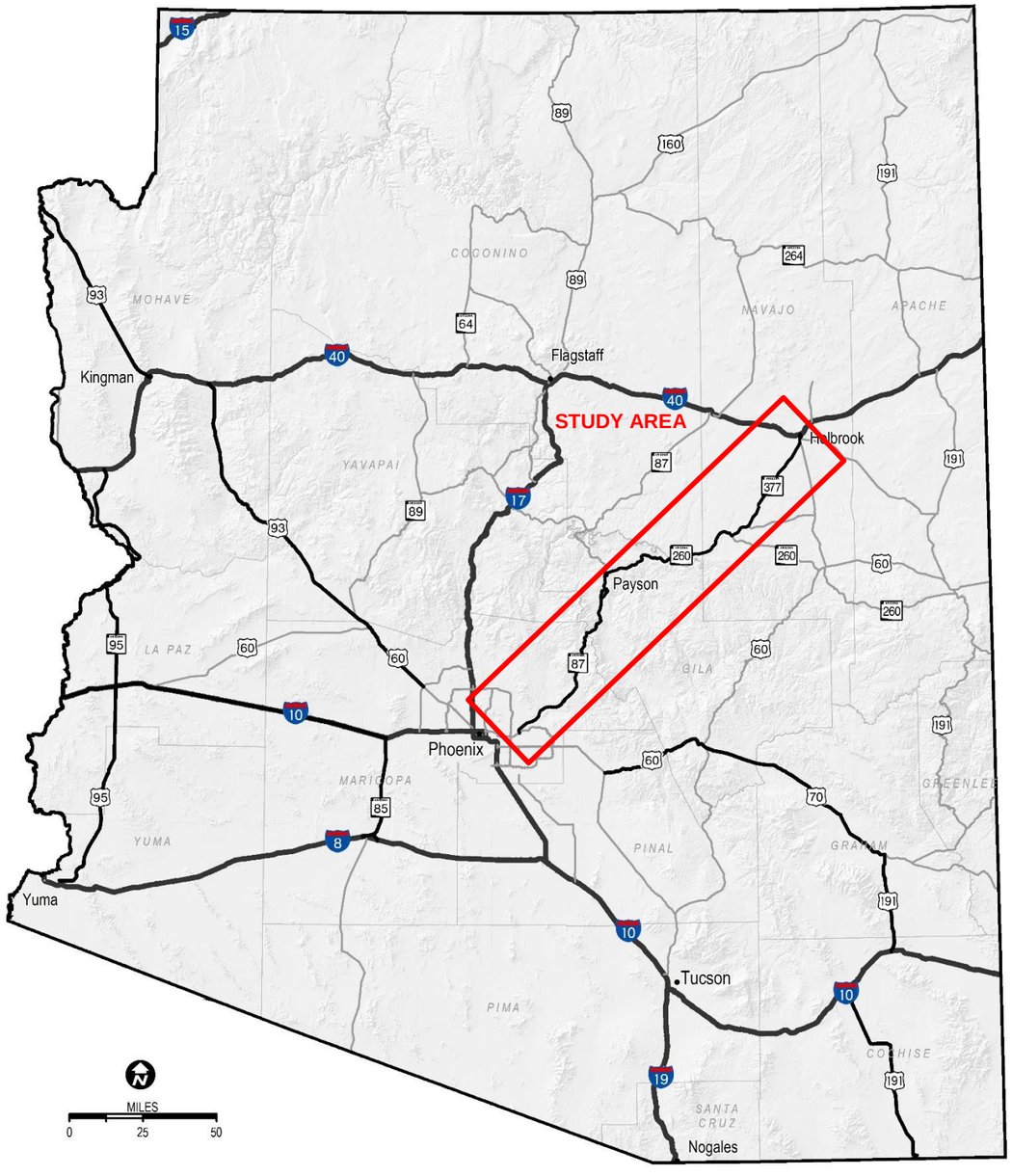
The third round (Round 3) of studies, initiated in Fall 2015, includes:

- I-10: California State Line to SR 85 and SR 85: I-10 to I-8
- I-10: SR 202L to the New Mexico State Line
- SR 87/SR 260/SR 377: SR 202L to I-40
- US 60/US 70: SR 79 to US 191 and US 191: US 70 to SR 80
- US 93/US 60: Nevada State Line to SR 303L

The studies under this program assess the overall health, or performance, of the state's strategic highways. The CPS identifies candidate solutions for consideration in the Multimodal Planning Division's (MPD) P2P project prioritization process, providing information to guide corridor-specific project selection and programming decisions.

The SR 87/SR 260/SR 377 corridor, depicted in **Figure 1**, is one of the strategic statewide corridors and the subject of this Round 3 CPS.

Figure 1: Corridor Study Area



1.1 Corridor Study Purpose

The purpose of the CPS is to measure corridor performance to inform the development of strategic solutions that are cost-effective and account for potential risks. This purpose can be accomplished by following the process described below:

- Inventory past improvement recommendations
- Define corridor goals and objectives
- Assess existing performance based on quantifiable performance measures
- Propose various solutions to improve corridor performance
- Identify specific solutions that can provide quantifiable benefits relative to the performance measures
- Prioritize solutions for future implementation

1.2 Study Goals and Objectives

The objective of this study is to identify a recommended set of prioritized potential strategic solutions for consideration in future construction programs, derived from a transparent, defensible, logical, and replicable process. The SR 87/SR 260/SR 377 CPS defines solutions and improvements for the corridor that are evaluated and ranked to determine which investments offer the greatest benefit to the corridor in terms of enhancing performance. Corridor benefits can be categorized by the following three investment types:

- Preservation: Activities that protect transportation infrastructure by sustaining asset condition or extending asset service life
- Modernization: Highway improvements that upgrade efficiency, functionality, and safety without adding capacity
- Expansion: Improvements that add transportation capacity through the addition of new facilities and/or services

This study identifies potential actions to improve the performance of the SR 87/SR 260/SR 377 corridor. Proposed actions are compared based on their likelihood of achieving desired performance levels, life-cycle costs, and cost-effectiveness to produce a prioritized list of solutions that help achieve corridor goals.

The following goals are identified as the desired outcome of this study:

- Link project decision-making and investments on key corridors to strategic goals
- Develop solutions that address identified corridor needs based on measured performance
- Prioritize improvements that cost-effectively preserve, modernize, and expand transportation infrastructure

1.3 Working Paper 6 Overview

The objective of Working Paper 6 is to document the evaluation of the strategic solutions identified in Working Paper 5 for the SR 87/SR 260/SR 377 corridor. Pavement and Bridge solutions are evaluated using a Life-Cycle Cost Analysis (LCCA). In addition, this evaluation includes a risk-based Performance Effectiveness Evaluation on each solution to determine the amount of benefit to the performance scores each solution produces. The result of this evaluation is a prioritized list of recommendations for the SR 87/SR 260/SR 377 corridor.

1.4 Corridor Overview and Location

The SR 87/SR 260/SR 377 corridor between Loop 202 and I-40 provides movement for freight, tourism, and recreation needs within Arizona. It provides a key link between the Phoenix metropolitan area and the northeast region of the state and serves intrastate, interstate, and international commerce. The corridor connects Mesa, Fountain Hills, Payson, Heber-Overgaard and Holbrook as well as the Salt River Pima Maricopa Indian Community (SRPMIC), Fort McDowell-Yavapai, and Tonto Apache tribes. This corridor also serves a number of recreational areas and National Forests. The SR 87/SR 260/SR 377 corridor includes portions of SR 87, SR 260, SR 277, SR 377, SR 77, and I-40 Business Route (I-40B).

The SR 87/SR 260/SR 377 corridor between Loop 202 and I-40 is approximately 175 miles in length. The SR 87/SR 260/SR 377 corridor is located in three ADOT Districts (Central, Northcentral, and Northeast); three planning areas (Maricopa Association of Governments [MAG], Central Arizona Governments [CAG], and Northern Arizona Council of Governments [NACOG]); and four counties (Maricopa, Gila, Coconino, and Navajo).

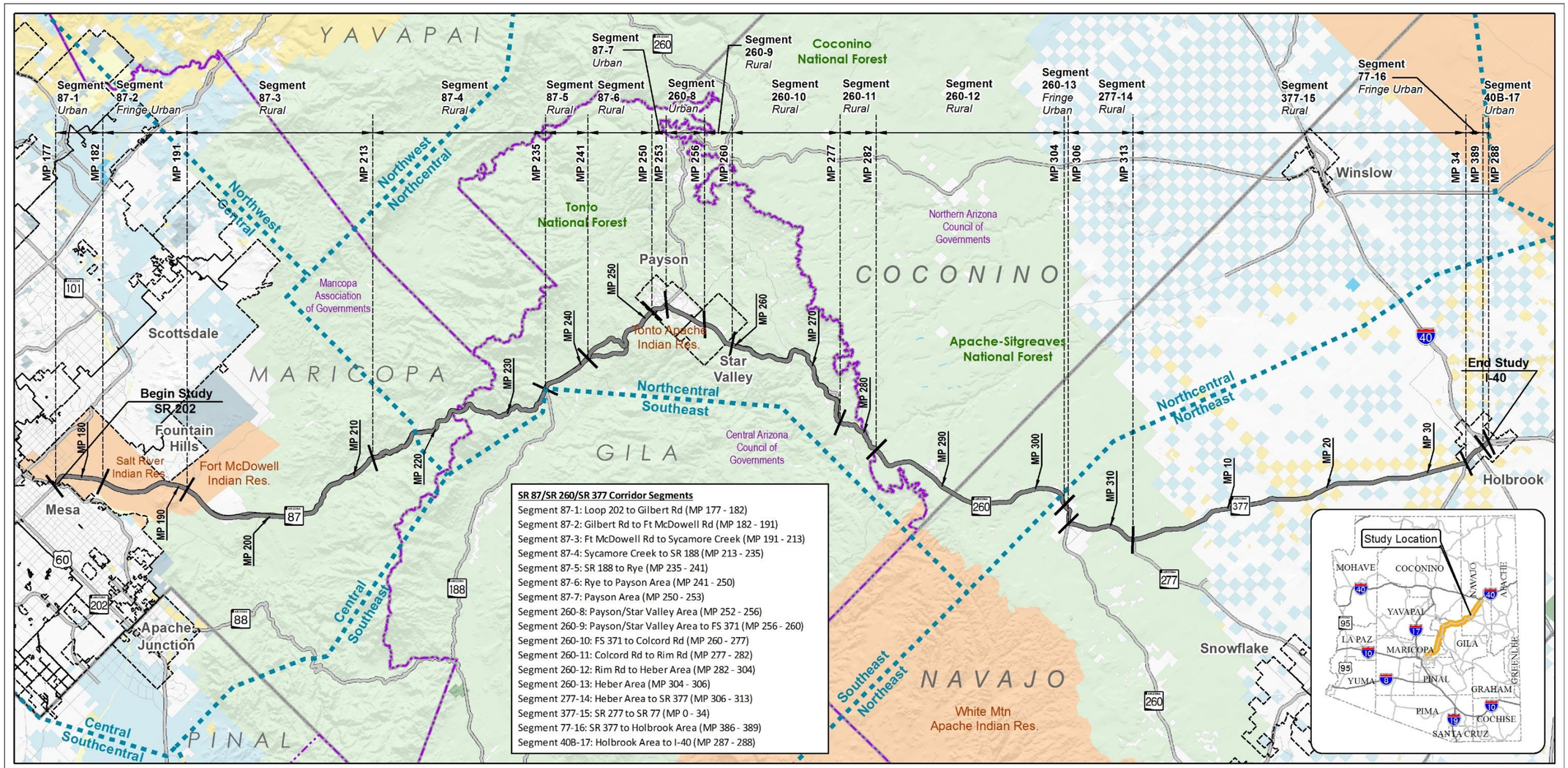
1.5 Corridor Segments

The SR 87/SR 260/SR 377 corridor is divided into 17 planning segments to allow for an appropriate level of detailed needs analysis, performance evaluation, and comparison between different segments of the corridor. The corridor is segmented at logical breaks where the context changes due to differences in characteristics such as terrain, daily traffic volumes, or roadway typical sections. Corridor segments are described in **Table 1** and shown in **Figure 2**.

Table 1: SR 87/SR 260/SR 377 Corridor Segments

Segment #	Begin	End	Approx. Begin Milepost	Approx. End Milepost	Approx. Length (miles)	Typical Through Lanes (NB/EB, SB/WB)	2014 Average Annual Daily Traffic Volume (vpd)	Character Description
87-1	Loop 202	Gilbert Rd	177	182	5	2,2	15,000 – 16,000	This segment has interrupted flow, numerous access points, consistent traffic volumes, a five-lane undivided or four-lane divided section, and is located in the Phoenix metropolitan urban area.
87-2	Gilbert Rd	Fort McDowell Rd	182	191	9	2,2	15,000 – 16,000	This segment has interrupted flow characteristics, access points, consistent traffic volumes, a four-lane divided section, and is located in the fringes of the Phoenix metropolitan urban area.
87-3	Fort McDowell Rd	Sycamore Creek	191	213	22	2,2	9,000 – 10,000	This rural four-lane divided segment with uninterrupted flow has consistent topography and traffic volumes.
87-4	Sycamore Creek	SR 188	213	235	22	2,2	10,000 – 11,000	This rural four-lane divided segment with uninterrupted flow has steep terrain and a curvy alignment.
87-5	SR 188	Rye	235	241	6	2,2	11,000 – 12,000	This rural four-lane divided segment with uninterrupted flow has flatter terrain than surrounding segments.
87-6	Rye	Green Valley Pkwy/BIA 101	241	250	9	2,2	11,000 – 12,000	This rural segment with uninterrupted flow is a climbing four-lane divided section.
87-7	Green Valley Pkwy/BIA 101	SR 260	250	253	3	2,2	19,000 – 20,000	This segment has interrupted flow, numerous access points, is comprised of a five-lane undivided section and is located in the Payson urban area.
260-8	SR 87	Mayfield Canyon Rd	252	256	4	2,2	14,000 – 15,000	This segment is comprised of a five-lane undivided section. It is located in the Payson/Star Valley urban area.
260-9	Mayfield Canyon Rd	FS 371	256	260	4	1,1	13,000 – 14,000	This rural segment with uninterrupted flow is comprised of a two-lane undivided section.
260-10	FS 371	Colcord Rd	260	277	17	2,2	6,000 – 7,000	This rural segment with uninterrupted flow is comprised of a four-lane divided section. It is a climbing section.
260-11	Colcord Rd	Rim Rd	277	282	5	2,2	6,000 – 7,000	This rural segment with uninterrupted flow is comprised of a four-lane undivided section. It includes a climbing section to the top of Mogollon Rim.
260-12	Rim Rd	Black Canyon Ln	282	304	22	1,1	5,000 – 6,000	This rural segment with uninterrupted flow is comprised of a two-lane undivided section.
260-13	Black Canyon Ln	SR 277	304	306	2	2,2	7,000 – 8,000	This segment with uninterrupted flow is comprised of a five-lane undivided section. It is located in the fringes of the Heber-Overgaard urban area.
277-14	SR 260	SR 377	306	313	7	1,1	1,000 – 2,000	This rural segment with uninterrupted flow is a two-lane undivided section.
377-15	SR 277	SR 77	0	34	34	1,1	2,000 – 3,000	This rural segment with uninterrupted flow is a two-lane undivided section.
77-16	SR 377	I-40 Business	386	389	3	1,1	7,000 – 8,000	This segment has interrupted flow, numerous access points, a two-lane or four-lane undivided section, and is located in the fringes of the Holbrook urban area.
40B-17	SR 77	I-40/Navajo Blvd TI	287	288	1	2,2	10,000 – 11,000	This segment has interrupted flow, numerous access points, a four-lane or five-lane undivided section, and is located in the Holbrook urban area.

Figure 2: Corridor Location and Segments



SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Project Vicinity and Segmentation

2.0 CANDIDATE SOLUTION EVALUATION PROCESS

Candidate solutions are evaluated using the following steps: LCCA (where applicable), Performance Effectiveness Evaluation, Solution Risk Analysis, and Candidate Solution Prioritization. The methodology and approach to this evaluation are shown in **Figure 3** and described more fully below.

2.1 Life-Cycle Cost Analysis

All Pavement and Bridge candidate solutions have two options: rehabilitation/repair or reconstruction. These options are evaluated through an LCCA to determine the best approach for each location where a Pavement or Bridge solution is recommended. The LCCA can eliminate options from further consideration and identify which options should be carried forward for further evaluation.

When multiple independent candidate solutions are developed for Mobility, Safety, or Freight strategic investment areas, these candidate solution options advance directly to the Performance Effectiveness Evaluation without an LCCA.

2.2 Performance Effectiveness Evaluation

After completing the LCCA process, all remaining candidate solutions are evaluated based on their performance effectiveness. This process includes determining a Performance Effectiveness Score (PES) based on how much each solution impacts the existing performance and needs scores for each segment. This evaluation also includes a Performance Area Risk Analysis to help differentiate between similar solutions based on factors that are not directly addressed in the performance system.

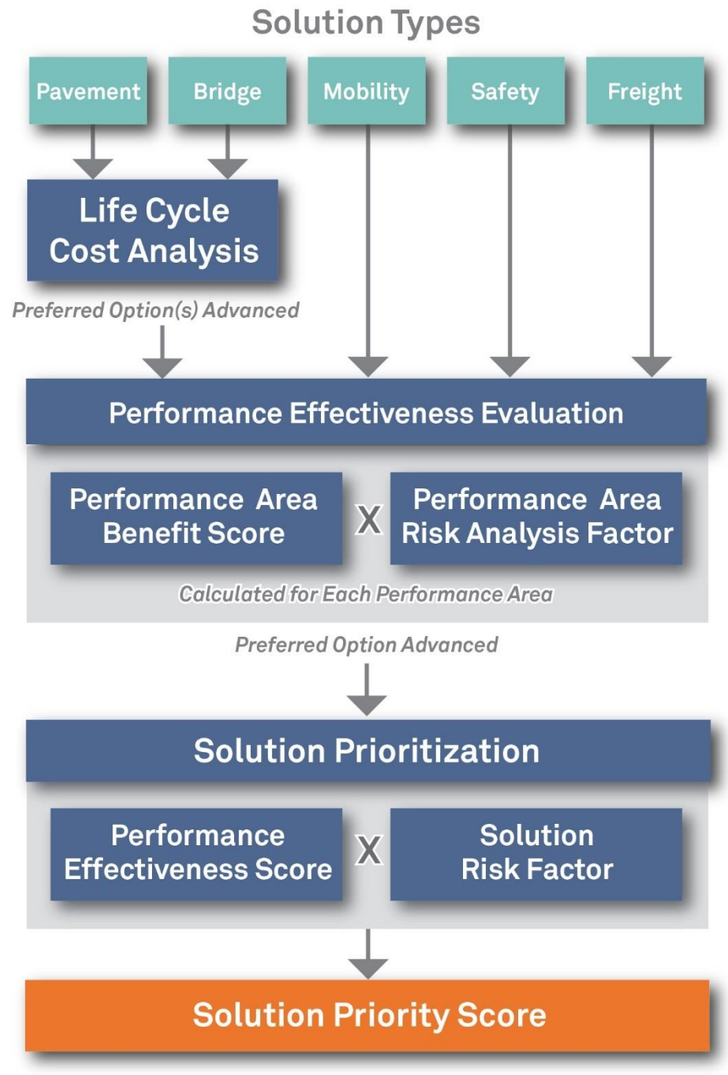
2.3 Solution Risk Analysis

All candidate solutions advanced through the Performance Effectiveness Evaluation are also evaluated through a Solution Risk Analysis process. A solution risk probability and consequence analysis is conducted to develop a solution-level risk weighting factor. This risk analysis is a numeric scoring system to help address the risk of not implementing a solution based on the likelihood and severity of the performance failure.

2.4 Candidate Solution Prioritization

The PES, weighted risk factor, and average segment need score are combined to create a prioritization score. The candidate solutions are ranked by prioritization score from highest to lowest. The highest prioritization score indicates the candidate solution that is recommended as the highest priority. Solutions that address multiple performance areas tend to score higher in this process.

Figure 3: Candidate Solution Evaluation Process



3.0 SOLUTION EVALUATION AND PRIORITIZATION

3.1 Candidate Solutions

The principal objective of the CPS is to identify strategic solutions (investments) that are performance-based to ensure that available funding resources are used to maximize the performance of the State's key transportation corridors. For each elevated need within a strategic investment area that is not screened out, a candidate solution is developed to address the identified need. Each candidate solution is assigned to one of the following three P2P investment categories based on the scope of the solution: preservation, modernization, or expansion.

The performance system and performance needs previously documented in Working Papers 2 and 4, respectively, serve as a foundation for developing candidate solutions for corridor preservation, modernization, and expansion.

Candidate solutions are not intended to recreate or replace results from normal programming processes. However, they should address elevated levels (High or Medium) of need and focus on investments in modernization projects to optimize current infrastructure. Ideally, strategic solutions should address overlapping needs and reduce costly repetitive maintenance. In addition, they should provide a measurable benefit.

Candidate solutions were developed after considering information from previous reports, field reviews, ADOT staff input, observable trends in the performance data, current standards, national and local best practices, and engineering judgement. **Table 2** identifies each strategic location that has been assigned a candidate solution with a number (e.g., CS87.1, CS87.2, etc.). Each candidate solution is comprised of one or more components to address the identified needs. Cost estimates for each candidate solution are provided in **Appendix A**.

Following the distribution of Draft Working Paper 5, candidate solutions were reviewed based on location, solution characteristics, and length. The following considerations were also made:

- Solutions that affect a specific subset of crashes (e.g. lighting, wildlife crossing or fencing) should be separated from other solutions and considered by themselves.
- Solutions that have an elevated crash modification factor (e.g. <0.50) should be separated from other solutions and considered by themselves (e.g. mainline realignment, parallel entry/exit ramps).
- Solutions should be packaged together by location/geography to the extent possible.

This analysis may have resulted in the combination or modification of the solutions presented in Working Paper 5.

Table 2: Candidate Solutions

Candidate Solution #	Segment	Location #	Beginning Milepost	Ending Milepost	Candidate Solution Name	Option*	Scope	Investment Category (Preservation [P], Modernization [M], Expansion [E])
CS87.1	87-1	L1	177	182	Salt River Area Safety Improvements	-	-Install warning signs and chevrons on curved Salt River bridge approaches -Install raised pavement markers along the outside edge line -Install lighting at Oak St (MP 178.4), Center St (MP 179.1), Mesa Dr (MP 179.7), and Camelback Rd (MP 181.0) -Install raised concrete barrier in median on Gila River bridge and approaches (MP 177-177.5)	M
CS87.2	87-3	L3/L4	191	213	Bush Highway Area Safety and Freight Improvements	-	-Rehabilitate shoulders (NB/SB MP 194-205) -Install speed feedback signs (NB MP 206.5 and 207.7, NB/SB before curves and intersection with FR 68 [MP 209.6]) -Widen inside shoulders (SB MP 211-209)	M
CS87.3	87-4	L6/L7	213	235	Sunflower Area Safety Improvements	-	-Install speed feedback signs and speed advisory warning signs with flashing beacons at curves (NB MP 213.2, 214.0, 217.8, 220.5, 224.5, 232.5; SB MP 231, 229.3, 221.0, 219.6, 216.0, 214.3) -Rehabilitate shoulders -Widen inside shoulders (SB MP 228.5-226.0) -Install rock-fall mitigation (NB MP 214.2-214.6; SB MP 228.9-228.7, 228.5-228.0, 217.6-218.0)	M
CS87.4	87-4	L8	213	223	Sunflower Area Freight Improvements	-	-Construct NB climbing lane, MP 213-215 and MP 219-223	M
CS87.5	87-4	L9	224	226	Slate Creek Pavement Improvements	A	-Rehabilitate pavement	P
						B	-Replace pavement	M
CS87.6	87-5	L10/L11	235	241	Rye Area Safety and Freight Improvements	-	-Install advisory sign about approaching area with intersections (Deer Creek Drive [MP 237.6], Gisela Road [MP 239.5], two intersections in Rye [MP 240.5 and MP 240.8]) -Install reduced speed advisory sign on SR 87 (NB MP 240, SB MP 241) -Install speed feedback signs (NB MP 240, SB MP 241) -On SR 188 approaching SR 87 add flashing beacons to WB stop sign	M
CS87.7	87-6	L13	241	250	Ox Bow Estates Area Safety Improvements	-	-Install speed feedback signs and speed advisory warning signs with flashing beacons at curves (SB MP 247, MP 245) -Implement variable speed limits MP 241-246 with new DMS and CCTV SB at MP 251 and new DMS and CCTV NB at MP 235 -Install RWIS at MP 245 with dynamic weather warning beacons	M
CS87.8	87-6	L12	243	247	Ox Bow Estates Area Freight Improvements	-	-Construct NB climbing lane	M
CS87.9	87-6	L14	246	251	Mazatzal Area Safety Improvements	-	-Widen shoulders SB MP 246.2-250.9	M

*'-' indicates only one solution is being proposed and no options are being considered

Table 2: Candidate Solutions (continued)

Candidate Solution #	Segment	Location #	Beginning Milepost	Ending Milepost	Candidate Solution Name	Option*	Scope	Investment Category (Preservation [P], Modernization [M], Expansion [E])
CS260.10	87-7 & 260-8	L15/L16	251 (SR 87)	253 (SR 260)	Payson Area Safety and Freight Improvements	A	-Implement signal coordination/adaptive control for six signals in Payson urban area (SR 87/SR 260 intersection, SR 260/Payson Village Center, SR 260/Manzanita Dr, SR 87/Main St, SR 87/Bonita St, and SR 87/Green Valley Parkway/BIA 101) -Implement protected/permitted left-turn phasing at SR 87/Manzanita Dr intersection (NB and SB approaches) and provide advance signal advisory sign with flashing beacons WB on SR 87	M
						B	-Reconstruct three signalized intersections as double-lane roundabouts (SR 87/Bonita St, SR 87/SR 260 intersection, and SR 260/Manzanita Dr) -Implement signal coordination/adaptive control for three signals in Payson urban area (SR 87/Green Valley Parkway, SR 87/Main St, and SR 260/Payson Village Center)	M
CS260.11	260-9	L17/L18	256	260	Lion Springs Area Mobility and Freight Improvements	-	-Reconstruct to 4-lane divided highway	E
CS260.12	260-10	L19	260	277	Christopher Creek Area Freight Improvements	-	-Install rock-fall mitigation (WB MP 262.2-262.6, 261.6-261.9, 269.0-269.1, 269.7-269.8, 271.3-271.5; EB MP 269.8-269.9, 272.6-272.7) -Implement variable speed limits at MP 272-277 and new DMS and CCTV at MP 272 EB	M
CS260.13	260-11	L20	277	282	Mogollon Rim Area Freight Improvements	-	-Install centerline rumble strips -Install rock-fall mitigation (WB MP 278.4-278.6, 279.8-280.9, 281.4-282) -Install RWIS at MP 282 with dynamic weather warning beacons -Implement variable speed limits at MP 277-282 and new DMS and CCTV at MP 282 WB	M
CS260.14	260-11	L20	277	280	Mogollon Rim Area Climbing Lane	-	-Construct EB climbing lane	M
CS260.15	260-12	L21/L22	282	304	Forest Lakes Area Safety and Freight Improvements	-	-Widen shoulders -Construct alternating passing lanes	M
CS77.16	77-16	L29/L30	386	389	Holbrook Area Mobility and Freight Improvements	A	-Construct new roadway connection between SR 377/SR 77 and I-40/40B West TI (Exit 285) west of Holbrook. Includes new bridge over Little Colorado River and overpass at railroad crossing	E
						B	-Construct new roadway connection between US 180/SR 77 and I-40/40B West TI (Exit 285) west of Holbrook. Includes new bridge over Little Colorado River and overpass at railroad crossing	E
						C	-Construct overpass at at-grade railroad crossing and new bridge over the Little Colorado River adjacent to existing SR 77 alignment	E

*'-' indicates only one solution is being proposed and no options are being considered

3.2 Life-Cycle Cost Analysis

LCCA is conducted for any candidate solution that is developed as a result of a need in the Pavement or Bridge performance area. The intent of the LCCA is to determine which options warrant further investigation and eliminate options that would not be considered strategic.

LCCA is an economic analysis that compares cost streams over time and presents the results in a common measure, the present value of all future costs. The cost stream occurs over an analysis period that is long enough to provide a reasonably fair comparison among alternatives that may differ significantly in scale of improvement actions over shorter time periods. For both bridge and pavement LCCA, the costs are focused on agency (ADOT) costs for corrective actions to meet the objective of keeping the bridge or pavement serviceable over a long period of time.

LCCA is performed to provide a more complete holistic perspective on asset performance and agency costs over the life of an investment stream. This approach helps ADOT look beyond initial and short-term costs that often dominate the considerations in transportation investment decision-making and programming.

Bridge LCCA

For the bridge LCCA, three basic strategies are analyzed that differ in timing and scale of improvement actions to maintain the selected bridges, as described below:

- Bridge replacement (large upfront cost but small ongoing costs afterwards)
- Bridge rehabilitation until replacement (moderate upfront costs then small to moderate ongoing costs until replacement)
- On-going repairs until replacement (low upfront and ongoing costs until replacement)

The bridge LCCA model developed for the CPS reviews the characteristics of the candidate bridges including bridge ratings and deterioration rates to develop the three improvement strategies (full replacement, rehabilitation until replacement, and repair until replacement). Each strategy consists of a set of corrective actions that contribute to keeping the bridge serviceable over the analysis period. Cost and effect of these improvement actions on the bridge condition are essential parts of the model. Other considerations in the model include bridge age, elevation, pier height, length-to-span ratio, skew angle, and substandard characteristics such as shoulders and vehicle clearance. The following assumptions are included in the bridge LCCA model:

- The bridge LCCA only addresses the structural condition of the bridge and does not address other issues or costs
- The bridge will require replacement at the end of its 75-year service life regardless of current condition
- The bridge elevation, pier height, skew angle, and length-to-span ratio can affect the replacement and rehabilitation costs
- The current and historical ratings are used to estimate a rate of deterioration for each candidate bridge
- Following bridge replacement, repairs will be needed every 20 years
- Different bridge repair and rehabilitation strategies have different costs, expected service life, and benefit to the bridge rating
- The net present value of future costs is discounted at 3% and all dollar amounts are in 2015 dollars
- If the LCCA evaluation recommends rehabilitation or repair, the solution is not considered strategic and the rehabilitation or repair will be addressed by normal programming processes
- Because this LCCA is conducted at a planning level, and due to the variabilities in costs and improvement strategies, the LCCA net present value results that are within 15% should be considered equally: in such a case, the project should be carried forward as a strategic replacement project – more detailed scoping will confirm if replacement or rehabilitation is needed

Based on the candidate solutions presented in **Table 2**, LCCA was not conducted for any bridges on the SR 87/SR 260/SR 377 corridor. A summary of this analysis is shown in **Table 3**. Additional information regarding the LCCA is included in **Appendix B**.

Pavement LCCA

The LCCA approach to pavement is very similar to the process used for bridges. For the pavement LCCA, three basic strategies are analyzed that differ in timing and scale of improvement actions to maintain the selected pavement, as described below:

- Pavement replacement (large upfront cost but small ongoing costs afterwards – could be replacement with asphalt or concrete pavement)
- Pavement major rehabilitation until replacement (moderate upfront costs then small to moderate ongoing costs until replacement)
- Pavement minor rehabilitation until replacement (low upfront and ongoing costs until replacement)

The pavement LCCA model developed for the CPS reviews the characteristics of the candidate paving locations including the historical rehabilitation frequency to develop potential improvement strategies (full replacement, major rehabilitation until replacement, and minor rehabilitation until replacement, for either concrete or asphalt, as applicable). Each strategy consists of a set of corrective actions that contribute to keeping the pavement serviceable over the analysis period. The following assumptions are included in the pavement LCCA model:

- The pavement LCCA only addresses the condition of the pavement and does not address other issues or costs
- The historical pavement rehabilitation frequencies at each location are used to estimate future rehabilitation frequencies
- Different pavement replacement and rehabilitation strategies have different costs and expected service life

- The net present value of future costs is discounted at 3% and all dollar amounts are in 2015 dollars
- If the LCCA evaluation recommends rehabilitation or repair, the solution will not be considered strategic and the rehabilitation will be addressed by normal programming processes
- Because this LCCA is conducted at a planning level, and due to variabilities in costs and improvement strategies, the LCCA net present value results that are within 15% should be considered equally; in such a case, the project should be carried forward as a strategic replacement project - more detailed scoping will confirm if replacement or rehabilitation is needed.

Based on the candidate solutions presented in **Table 2**, LCCA was conducted for one pavement project on the SR 87/SR 260/SR 377 corridor. A summary of this analysis is shown in **Table 4**. Additional information regarding the LCCA is contained in **Appendix B**.

As shown in **Table 3** and **Table 4**, the following conclusions were determined based on the LCCA:

- Reconstruction was determined to be the most effective approach for the pavement candidate solution CS87.5; the replace pavement option of this solution will be carried forward to the performance effectiveness process

Table 3: Bridge Life-Cycle Cost Analysis Results

Candidate Solution	Present Value at 3% Discount Rate ($)			Ratio of Present Value Compared to Lowest Present Value			Other Needs	Results
	Replace	Rehab	Repair	Replace	Rehab	Repair		
No LCCA conducted for any bridge candidate solution on the SR 87/SR 260/SR 377 corridor								

Table 4: Pavement Life-Cycle Cost Analysis Results

Candidate Solution	Present Value at 3% Discount Rate ($)				Ratio of Present Value Compared to Lowest Present Value				Other Needs	Results
	Concrete Reconstruction	Asphalt Reconstruction	Asphalt Medium Rehabilitation	Asphalt Light Rehabilitation	Concrete Reconstruction	Asphalt Reconstruction	Asphalt Medium Rehabilitation	Asphalt Light Rehabilitation		
Slate Creek Pavement Improvements (CS87.5, MP 224-226)	**$9,046,928**	$9,478,848	$9,224,966	$9,478,766	1.00	1.05	1.02	1.05	-	Concrete reconstruction is the lowest option and asphalt reconstruction is within 15% of the lowest rehabilitation cost

3.3 Performance Effectiveness Evaluation

The results of the Performance Effectiveness Evaluation are combined with the results of a Performance Area Risk Analysis to determine a Performance Effectiveness Score (PES). The objectives of the Performance Effectiveness Evaluation include:

- Measure the benefit to the performance system versus the cost of the solution
- Include risk factors to help differentiate between similar solutions
- Apply to each performance area that is affected by the candidate solution
- Accounts for emphasis areas identified for the corridor

The Performance Effectiveness Evaluation includes the following steps:

- Estimate the post-solution performance for each of the five performance areas (Pavement, Bridge, Mobility, Safety, and Freight)
- Use the post-solution performance scores to calculate a post-solution level of need for each of the five performance areas
- Compare the pre-solution level of need to the post-solution level of need to determine the reduction in level of need (potential solution benefit) for each of the five performance areas
- Calculate performance area risk weighting factors for each of the five performance areas
- Use the reduction in level of need (benefit) and risk weighting factors to calculate the PES

Post-Solution Performance Estimation

For each performance area, a slightly different approach is used to estimate the post-solution performance. This process is based on the following assumptions:

- Pavement:
  - The International Roughness Index (IRI) rating would decrease (to 30 for replacement or 45 for rehabilitation)
  - The Cracking rating would decrease (to 0 for replacement or rehabilitation)
- Bridge:
  - The structural ratings would increase (+1 for repair, +2 for rehabilitation, or increase to 8 for replacement)
  - The Sufficiency Rating would increase (+10 for repair, +20 for rehabilitation, or increase to 98 for replacement)
- Mobility:
  - Additional lanes would increase the capacity and therefore affect the Mobility Index and associated secondary measures
  - Other improvements (e.g., ramp metering, parallel ramps, variable speed limits) would also increase the capacity (to a lesser extent than additional lanes) and therefore would affect the Mobility Index and associated secondary measures
  - Changes in the Mobility Index (due to increased capacity) would have a direct effect on the Travel Time Index (TTI) secondary measure
  - Changes in the Mobility Index (due to increased capacity) and Safety Index (due to crash reductions) would have a direct effect on the Planning Time Index (PTI) secondary measure
  - Changes in the Safety Index (due to crash reductions) would have a direct effect on the Closure Extent secondary measure
- Safety:
  - Crash modification factors were developed that would be applied to estimate the reduction in crashes (for additional information see **Appendix C**)
- Freight:
  - Changes in the Mobility Index (due to increased capacity) and Safety Index (due to crash reductions) would have a direct effect on the Freight Index and the Truck PTI (TPTI) secondary measure
  - Changes in the Mobility Index (due to increased capacity) would have a direct effect on the Truck TTI (TTTI) secondary measure
  - Changes in the Safety Index (due to crash reductions) would have a direct effect on the Closure Duration secondary measure

Performance Area Risk Analysis

The Performance Area Risk Analysis is intended to develop a numeric risk weighting factor for each of the five performance areas (Pavement, Bridge, Mobility, Safety, and Freight). This risk analysis addresses other considerations for each performance area that are not directly included in the performance system. A risk weighting factor is calculated for each candidate solution based on the specific characteristics at the solution location. For example, the Pavement Risk Factor is based on factors such as the elevation, daily traffic volumes, and amount of truck traffic. Additional information regarding the Performance Area Risk Factors is included in **Appendix D**.

Following the calculation of the reduction in level of need (benefit) and the Performance Area Risk Factors, these values are used to calculate the PES. In addition, the reduction in level of need in each emphasis area is also included in the PES.

Net Present Value Factor

The benefit (reduction in need) is measured as a one-time benefit. However, different types of solutions will have varying service lives during which the benefits will be obtained. For example, a preservation solution would likely have shorter stream of benefits over time when compared to a modernization or expansion solution. To address the varying lengths of benefit streams, each solution is classified as a 10-year, 20-year, 30-year, or 75-year benefit stream, or the net present value (NPV) factor (F_{NPV}). A 3% discount rate is used to calculate F_{NPV} for each classification of solution. The service lives and respective factors are described below:

- A 10-year service life is generally reflective of a preservation solution; this would include pavement and bridge preservation solutions which would likely have a 10-year stream of benefits; for these solutions, a F_{NPV} of 8.8 is used in the PES calculation

- A 20-year service life is reflective of modernization solutions that generally do not include new infrastructure; these solutions would likely have a 20-year stream of benefits; for these solutions, a F_{NPV} of 15.3 is used in the PES calculation
- A 30-year service life is generally reflective of an expansion solution or a modernization solution that includes new infrastructure; these solutions would likely have a 30-year stream of benefits; for these solutions, a F_{NPV} of 20.2 is used in the PES calculation
- A 75-year service life was used for bridge replacement solutions; for these solutions, a F_{NPV} of 30.6 is used in the PES calculation

Vehicle-Miles Travelled Factor

Another factor in assessing benefits is the number of travelers who would benefit from the implementation of the candidate solution. This factor varies between candidate solutions depending on the length of the solution and the magnitude of daily traffic volumes. Multiplying the solution length by the daily traffic volume results in vehicle-miles travelled (VMT), which provides a measure of the amount of traffic exposure that would receive the benefit of the proposed solution. The VMT is converted to a VMT factor (known as F_{VMT}), which is on a scale between 0 and 5, using the equation below:

$$F_{VMT} = 5 - (5 \times e^{VMT \times -0.0000139})$$

Performance Effectiveness Score

The PES is calculated using the following equation:

PES = ((Sum of all Risk Factored Benefit Scores + Sum of all Risk Factored Emphasis Area Scores) / Cost) x F_{VMT} x F_{NPV}

Where,

Risk Factored Benefit Score = Reduction in Segment-Level Need (benefit) x Performance Area Risk Weighting Factor (calculated for each performance area)

Risk Factored Emphasis Area Score = Reduction in Corridor-Level Need x Performance Area Risk Factors x Emphasis Area Factor (calculated for each emphasis area)

*Cost = estimated cost of candidate solution in millions of dollars (see **Appendix A**)*

F_{VMT} = Factor between 0 and 5 to account for VMT at location of candidate solution based on existing (2014) daily volume and length of solution

F_{NPV} = Factor (ranging from 8.8 to 30.6 as previously described) to address anticipated longevity of service life (and duration of benefits) for each candidate solution

The resulting PES values are shown in **Table 5**. Additional information regarding the calculation of the PES is contained in **Appendix E**.

For candidate solutions with multiple options to address Mobility, Safety, or Freight needs, the PES should be compared to help identify the best performing option. If one option clearly performs better than the other options (e.g., more than twice the PES value and a difference in magnitude of at least 20 points), the other options should be eliminated from further consideration. If multiple options have similar PES values, those options should all be advanced to the prioritization process. On the SR 87/SR 260/SR 377 corridor, the following candidate solutions have options to address Mobility, Safety, or Freight needs:

- CS77.16 (A, B, and C) – Holbrook Area Mobility and Freight Improvements

Based on a review of the PES values for solution CS77.16, all of the candidate solution options (A, B, and C) were advanced to the candidate solution prioritization process.

As was previously mentioned, rehabilitation or repair was determined to be the most effective approach for the candidate solution listed below that was subjected to LCCA so this candidate solution was dropped from further consideration. No PES value was calculated for this solution and it does not appear in **Table 5**:

- Slate Creek Pavement Improvements (CS87.5, MP 224-226)

Table 5: Performance Effectiveness Scores

Candidate Solution #	Segment #	Candidate Solution Name	Milepost Location	Estimated Cost* (in millions)	Risk Factored Benefit Score					Risk Factored Emphasis Area Scores			Total Factored Benefit Score	F_{VMT}	F_{NPV}	Performance Effectiveness Score
					Pavement	Bridge	Mobility	Safety	Freight	Mobility	Safety	Freight				
CS87.1	87-1	Salt River Area Safety Improvements	177-182	$4.2	0.00	0.00	0.08	18.38	0.25	0.00	0.81	0.00	19.52	1.43	15.3	100.6
CS87.2	87-3	Bush Highway Area Safety and Freight Improvements	191-213	$6.8	0.00	0.00	1.83	2.23	3.84	0.00	0.30	0.05	8.24	3.72	15.3	69.1
CS87.3	87-4	Sunflower Area Safety Improvements	213-235	$18.3	0.00	0.00	2.74	5.71	8.08	0.00	1.04	0.06	17.62	4.78	15.3	70.4
CS87.4	87-4	Sunflower Area Freight Improvements	213-219	$42.0	0.00	0.00	0.56	1.50	2.01	0.01	0.28	0.01	4.38	1.81	20.2	3.8
CS87.5B	87-4	Slate Creek Pavement Improvements (Replace)	224-226	$7.2	0.00	0.00	1.29	1.83	2.45	0.00	0.34	0.02	5.92	0.70	15.3	8.8
CS87.6	87-5	Rye Area Safety and Freight Improvements	235-241	$0.2	0.00	0.00	0.73	0.62	0.51	0.00	0.02	0.01	1.89	1.53	8.8	115.8
CS87.7	87-6	Ox Bow Estates Area Safety Improvements	241-250	$2.4	0.00	0.00	1.02	1.18	0.67	0.01	0.11	0.01	3.00	2.79	15.3	53.3
CS87.8	87-6	Ox Bow Estates Area Freight Improvements	243-247	$25.4	0.00	0.00	0.55	0.06	0.24	0.01	0.01	0.00	0.87	1.39	20.2	1.0
CS87.9	87-6	Mazatzal Area Safety Improvements	246-251	$2.3	0.00	0.00	1.31	5.44	0.46	0.00	0.52	0.01	7.74	1.59	15.3	82.6
CS260.10A	87-7 and 260-8	Payson Area Safety and Freight Improvements	251-253	$0.4	0.00	0.00	0.12	2.94	0.09	0.00	0.29	0.00	3.44	1.98	8.8	150.2
CS260.10B	87-7 and 260-8	Payson Area Safety and Freight Improvements	251-253	$13.8	0.00	0.00	0.68	3.93	0.70	0.00	0.78	0.01	6.75	1.98	20.2	19.6
CS260.11	260-9	Lion Springs Area Mobility and Freight Improvements	256-260	$50.0	0.00	0.00	49.54	7.43	4.63	0.16	0.19	0.03	61.98	2.68	20.2	67.1
CS260.12	260-10	Christopher Creek Area Freight Improvements	260-277	$6.1	0.00	0.00	0.36	0.33	0.53	0.01	0.05	0.02	1.29	2.09	15.3	6.4
CS260.13	260-11	Mogollon Rim Area Freight Improvements	277-282	$8.5	0.00	0.00	1.12	0.21	0.95	0.00	0.04	0.01	2.33	1.73	15.3	7.3
CS260.14	260-11	Mogollon Rim Area Climbing Lane	277-280	$19.1	0.00	0.00	0.46	0.00	0.18	0.00	0.00	0.00	0.64	0.60	20.2	0.4
CS260.15	260-12	Forest Lakes Area Safety and Freight Improvements	282-304	$56.5	0.00	0.00	7.09	13.21	12.44	0.06	1.78	0.19	34.76	4.19	20.2	52.1
CS77.16A	77-16	Holbrook Area Mobility and Freight Improvements (SR 377/SR 77 connection)	386-389	$92.1	0.00	0.00	14.08	12.39	12.09	0.04	0.22	0.24	39.04	1.09	30.6	14.1
CS77.16B	77-16	Holbrook Area Mobility and Freight Improvements (US 180/SR 77 connection)	386-389	$75.8	0.00	0.00	13.76	12.39	12.09	0.05	0.22	0.24	38.74	0.41	30.6	6.4
CS77.16C	77-16	Holbrook Area Mobility and Freight Improvements (adjacent to SR 77)	386-389	$46.4	4.34	5.54	11.48	118.42	12.10	0.01	2.15	0.24	154.28	0.31	30.6	31.6

*: See Table 6 for total construction costs

3.4 Solution Risk Analysis

Following the calculation of the PES, an additional step is taken to develop a prioritized list of solutions. A solution risk probability and consequence analysis is conducted to develop a solution-level risk weighting factor. This risk analysis is a numeric scoring system to help address the risk of not implementing a solution based on the likelihood and severity of performance failure. **Figure 4** shows the risk matrix used to develop the risk weighting factors.

Figure 4: Risk Matrix

		Severity/Consequence				
		Insignificant	**Minor**	**Significant**	**Major**	**Catastrophic**
Frequency/ Likelihood	**Very Rare**	Low	Low	Low	Moderate	Major
	Rare	Low	Low	Moderate	Major	Major
	Seldom	Low	Moderate	Moderate	Major	Severe
	Common	Moderate	Moderate	Major	Severe	Severe
	Frequent	Moderate	Major	Severe	Severe	Severe

Using the risk matrix in **Figure 4**, numeric values were assigned to each category of frequency and severity. The higher the risk, the higher the numeric factor that was assigned. The risk weight for each area of the matrix was calculated by multiplying the severity factor times the frequency factor. These numeric factors are shown in **Figure 5**.

Figure 5: Numeric Risk Matrix

			Severity/Consequence				
			Insignificant	**Minor**	**Significant**	**Major**	**Catastrophic**
		Weight	1.00	1.10	1.20	1.30	1.40
Frequency/ Likelihood	**Very Rare**	1.00	1.00	1.10	1.20	1.30	1.40
	Rare	1.10	1.10	1.21	1.32	1.43	1.54
	Seldom	1.20	1.20	1.32	1.44	1.56	1.68
	Common	1.30	1.30	1.43	1.56	1.69	1.82
	Frequent	1.40	1.40	1.54	1.68	1.82	1.96

Using the values in **Figure 5**, risk weighting factors were calculated for each of the following four risk categories: low, moderate, major, and severe. These values are simply the average of the values in **Figure 5** that fall within each category. The resulting average risk weighting factors are:

Low	Moderate	Major	Severe
1.14	1.36	1.51	1.78

The risk weighting factors listed above are assigned to the five performance areas as follows:

- Safety = 1.78
  - The Safety performance area quantifies the likelihood of fatal or incapacitating injury crashes; therefore, it is assigned the Severe (1.78) risk weighting factor
- Bridge = 1.51
  - The Bridge performance area focuses on the structural adequacy of the bridges; a failure may result in crashes or traffic being detoured for long periods of time resulting in significant travel time increases; therefore, it is assigned the Major (1.51) risk weighting factor
- Mobility and Freight = 1.36
  - The Mobility and Freight performance areas focus on capacity and congestion; failure in either of these performance areas would result in increased travel times but would not have significant effect on safety (crashes) that would not already be addressed in the Safety performance area; therefore, they are assigned the Moderate (1.36) risk weighing factor
- Pavement = 1.14
  - The Pavement performance area focuses on the ride quality of the pavement; failure in this performance area would likely be a spot location that would not dramatically affect drivers beyond what is already captured in the Safety performance area; therefore, it was assigned the Low (1.14) risk weighing factor

The benefit in each performance area is calculated for each candidate solution as part of the Performance Effectiveness Evaluation. Using this information on benefits and the risk factors listed above, a weighted (based on benefit) solution-level numeric risk factor is calculated for each candidate solution. For example, a solution that has 50% of its benefit in Safety and 50% of its benefit in Mobility has a weighted risk factor of 1.57 (0.50 x 1.78 + 0.50 x 1.36 = 1.57).

3.5 Candidate Solution Prioritization

The PES, weighted risk factor, and segment average need score are combined to create a prioritization score as follows:

Prioritization Score = PES x Weighted Risk Factor x Segment Average Need Score

Where:

PES = Performance Effectiveness Score as shown in ***Table 5***

Weighted Risk Factor = Weighted factor to address risk of not implementing a solution based on the likelihood and severity of the performance failure

Segment Average Need Score = Segment average need score as shown in Working Paper 4

The candidate solutions are ranked by prioritization score from highest to lowest. The highest prioritization score indicates the candidate solution that is recommended as the highest priority. Solutions that address multiple performance areas tend to score higher in this process. The prioritized list of candidate solutions is provided in the subsequent section. See **Appendix F** for additional information on the prioritization process.

4.0 SUMMARY OF CORRIDOR RECOMMENDATIONS

4.1 Prioritized Candidate Solution Recommendations

Table 6 and **Figure 6** show the prioritized candidate solutions recommended for the SR 87/SR 260/SR 377 corridor. Implementation of these solutions is anticipated to improve performance of the SR 87/SR 260/SR 377 corridor. The following observations were noted about the prioritized solutions:

- Most of the anticipated improvements in performance are in the Mobility, Safety, and Freight performance areas
- The highest-ranking solutions tended to have overlapping benefits in the Mobility, Safety, and Freight performance areas
- The highest priority solutions address needs in the Salt River area (MP 171-176) and Payson area (MP 250-252)

4.2 Other Corridor Recommendations

As part of the investigation of strategic investment areas and candidate solutions, other corridor recommendations can also be identified. These recommendations could include modifications to the existing Statewide Construction Program, areas for further study, or other corridor-specific recommendations that are not related to construction or policy. The list below identifies other corridor recommendations for the SR 87/SR 260/SR 377 corridor:

- Implement a driving impaired and speeding safety education campaign along the corridor
- Coordinate with AGFD to conduct a study on vehicle/wildlife conflicts on SR 87 between MP 233 and 241
- Conduct an access management study on SR 87 and SR 260 through the Town of Payson

4.3 Policy and Initiative Recommendations

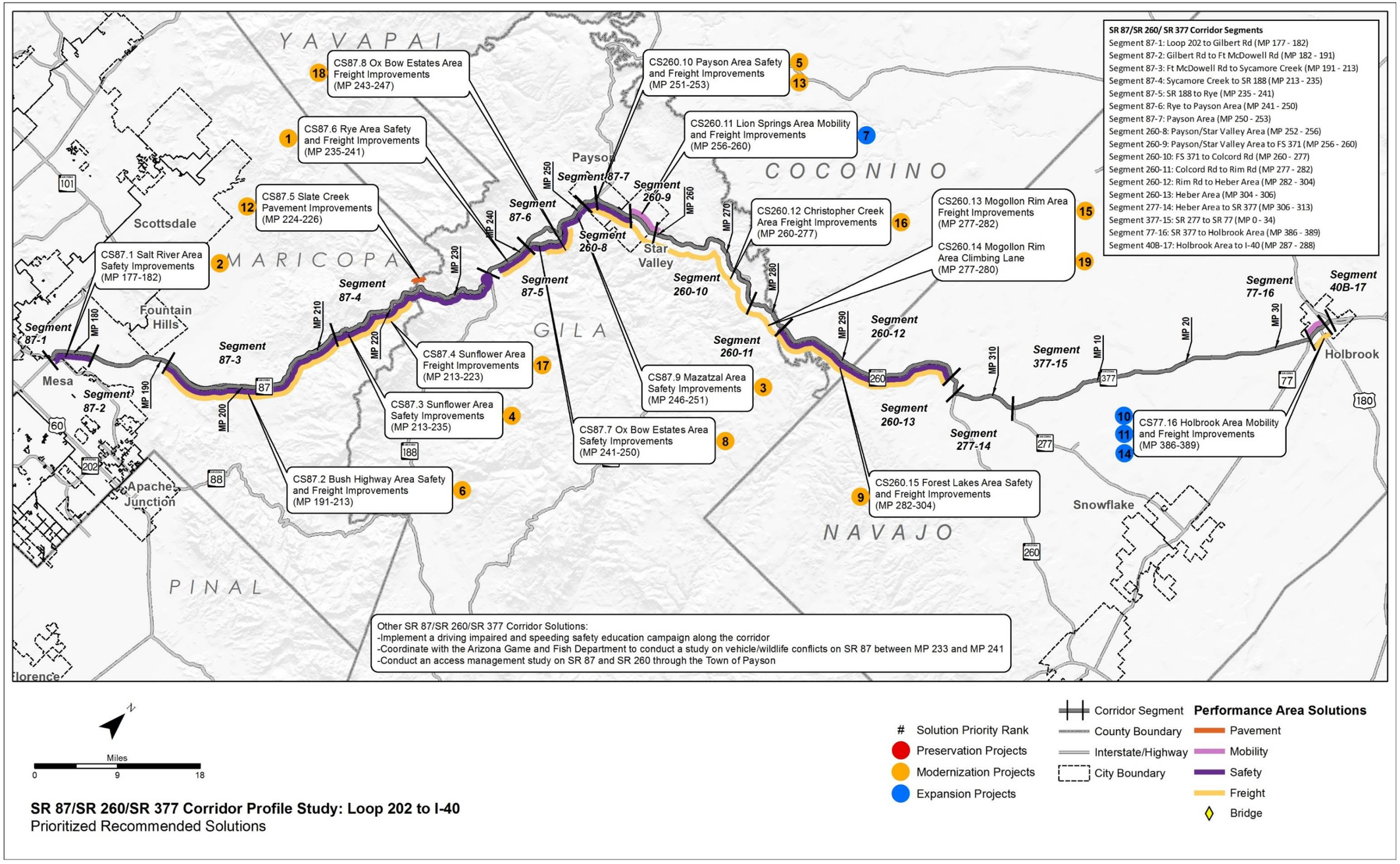
In addition to location-specific needs, general corridor and system-wide needs have also been identified through the CPS process. While these needs are more overarching and cannot be individually evaluated through this process, it is important to document them. A list of recommended policies and initiatives was developed for consideration when programming future projects not only on SR 87/SR 260/SR 377, but across the entire state highway system where the conditions are applicable. The following list, which is in no particular order of priority, was derived from the Round 1, Round 2, and Round 3 CPS:

- Install Intelligent Transportation System (ITS) conduit with all new infrastructure projects
- Prepare strategic plans for Closed Circuit Television (CCTV) camera and Road Weather Information System (RWIS) locations statewide
- Leverage power and communication at existing weigh-in-motion (WIM), dynamic message signs (DMS), and call box locations to expand ITS applications across the state
- Consider solar power for lighting and ITS where applicable
- Investigate ice formation prediction technology where applicable
- Conduct highway safety manual evaluation for all future programmed projects
- Develop infrastructure maintenance and preservation plans (including schedule and funding) for all pavement and bridge infrastructure replacement or expansion projects
- Develop standardized bridge maintenance procedures so districts can do routine maintenance work
- Review historical ratings and level of previous investment during scoping of pavement and bridge projects. In pavement locations that warrant further investigation, conduct subsurface investigations during project scoping to determine if full replacement is warranted
- For pavement rehabilitation projects, enhance the amount/level of geotechnical investigations to address issues specific to the varying conditions along the project
- Expand programmed and future pavement projects as necessary to include shoulders
- Expand median cable barrier guidelines to account for safety performance
- Install CCTV cameras with all DMS
- In locations with limited communications, use CCTV cameras to provide still images rather than streaming video
- Develop statewide program for pavement replacement
- Install additional continuous permanent count stations along strategic corridors to enhance traffic count data
- When reconstruction or rehabilitation activities will affect existing bridge vertical clearance, the dimension of the new bridge vertical clearance should be a minimum of 16.25 feet, where feasible
- All new or reconstructed roadway/shoulder edges adjacent to an unpaved surface should be constructed with a Safety Edge
- Collision data on tribal lands may be incomplete or inconsistent; additional coordination for data on tribal lands is required to ensure adequate reflection of safety issues
- Expand data collection devices statewide to measure freight delay
- Evaluate and accommodate potential changes in freight and goods movement trends that may result from improvements and expansions to the state roadway network

Table 6: Prioritized Recommended Solutions

Rank	Candidate Solution #	Segment #	Candidate Solution Name	Milepost Location	Investment Category [P] Preservation [M] Modernization [E]Expansion	Estimated Cost (in millions)	Performance Effectiveness Score	Weighted Risk Factor	Segment Average Need Score	Prioritization Score	Percentage by which Solution Reduces Performance Area Needs				
											Pavement	Bridge	Mobility	Safety	Freight
1	CS87.6	87-5	Rye Area Safety and Freight Improvements	235-241	M	$0.2	115.8	1.50	1.38	241	0%	0%	20%	31%	2%
2	CS87.1	87-1	Salt River Area Safety Improvements	177-182	M	$4.2	100.6	1.77	1.31	233	0%	0%	3%	49%	19%
3	CS87.9	87-6	Mazatzal Area Safety Improvements	246-251	M	$2.3	82.6	1.68	1.62	225	0%	0%	10%	28%	2%
4	CS87.3	87-4	Sunflower Area Safety Improvements	213-235	M	$18.3	70.4	1.52	1.77	189	0%	0%	21%	47%	12%
5	CS260.10A	87-7 and 260-8	Payson Area Safety and Freight Improvements	251-253	M	$0.4	150.2	1.75	0.71	187	0%	0%	1%	18%	1%
6	CS87.2	87-3	Bush Highway Area Safety and Freight Improvements	191-213	M	$6.8	69.1	1.49	1.77	182	0%	0%	26%	56%	8%
7	CS260.11	260-9	Lion Springs Area Mobility and Freight Improvements	256-260	E	$50.0	67.1	1.41	1.80	170	0%	0%	90%	41%	11%
8	CS87.7	87-6	Ox Bow Estates Area Safety Improvements	241-250	M	$2.4	53.3	1.54	1.62	133	0%	0%	8%	5%	2%
9	CS260.15	260-12	Forest Lakes Area Safety and Freight Improvements	282-304	M	$56.5	52.1	1.54	1.62	130	0%	0%	51%	84%	43%
10	CS77.16C	77-16	Holbrook Area Mobility and Freight Improvements (adjacent to SR 77)	386-389	E	$46.4	31.6	1.69	2.10	112	100%	100%	48%	100%	95%
11	CS77.16A	77-16	Holbrook Area Mobility and Freight Improvements (SR 377/SR 77 connection)	386-389	E	$92.1	14.1	1.50	2.10	40	0%	0%	56%	10%	95%
12	CS87.5B	87-4	Slate Creek Pavement Improvements (Replace)	224-226	M	$7.2	8.8	1.51	1.77	23	0%	0%	11%	14%	4%
13	CS260.10B	87-7 and 260-8	Payson Area Safety and Freight Improvements	251-253	M	$13.8	19.6	1.65	0.71	23	0%	0%	8%	24%	14%
14	CS77.16B	77-16	Holbrook Area Mobility and Freight Improvements (US 180/SR 77 connection)	386-389	E	$75.8	6.4	1.50	2.10	20	0%	0%	57%	10%	95%
15	CS260.13	260-11	Mogollon Rim Area Freight Improvements	277-282	M	$8.5	7.3	1.40	1.20	12	0%	0%	10%	18%	3%
16	CS260.12	260-10	Christopher Creek Area Freight Improvements	260-277	M	$6.1	6.4	1.48	1.15	11	0%	0%	7%	11%	2%
17	CS87.4	87-4	Sunflower Area Freight Improvements	213-219	M	$42.0	3.8	1.53	1.77	10	0%	0%	5%	11%	3%
18	CS87.8	87-6	Ox Bow Estates Area Freight Improvements	243-247	M	$25.4	1.0	1.39	1.62	2	0%	0%	4%	0%	1%
19	CS260.14	260-11	Mogollon Rim Area Climbing Lane	277-280	M	$19.1	0.4	1.36	1.20	1	0%	0%	4%	0%	1%

Figure 6: Prioritized Recommended Solutions



SR 87/SR 260/SR 377 Corridor Profile Study: Loop 202 to I-40
Prioritized Recommended Solutions

4.4 Next Steps

The candidate solutions recommended in this study are not intended to be a substitute or replacement for traditional ADOT project development processes where various ADOT technical groups and districts develop candidate projects for consideration in the performance-based programming in the P2P process. Rather, these candidate solutions are intended to complement ADOT's traditional project development processes through a performance-based process to address needs in one or more of the five performance areas of Pavement, Bridge, Mobility, Safety, and Freight. Candidate solutions developed for the SR 87/SR 260/SR 377 corridor will be considered along with other candidate projects in the ADOT statewide programming process.

It is important to note that the candidate solutions are intended to represent strategic solutions to address existing performance needs related to the Pavement, Bridge, Mobility, Safety, and Freight performance areas. Therefore, the strategic solutions are not intended to preclude recommendations related to the ultimate vision for the corridor that may have been defined in the context of prior planning studies and/or design concept reports. Recommendations from such studies are still relevant to addressing the ultimate corridor objectives.

The concluding step in the CPS will be to produce a final report that summarizes Working Papers 1 through 6.

Upon completion of all three CPS rounds, the results will be incorporated into a summary document comparing all corridors that is expected to provide a performance-based review of statewide needs and candidate solutions.

APPENDIX A: CANDIDATE SOLUTION COST ESTIMATES

Candidate Solution #	Location #	Candidate Solution Name	Investment Category (Preservation [P], Modernization [M], Expansion [E])	Scope	BMP	EMP	Unit	Quantity	Factored Construction Unit Cost	Preliminary Engineering Cost	Design Cost	Right-of-Way Cost (assuming $12/sf)	Construction Cost	Total Cost
CS87.1	L1	Salt River Area Safety Improvements	M	Install warning signs on curved Salt River Bridge approaches	-	-	each	4	$5,500	$1,000	$2,000	$0	$22,000	$25,000
				Install chevrons on curved Salt River Bridge approaches	177	177.6	mi	0.6	$40,500	$1,000	$2,000	$0	$24,300	$27,300
				Install raised pavement markers along outside edge line	177	182	mi	5	$4,400	$1,000	$2,000	$0	$22,000	$25,000
				Install lighting at Oak St, Center St, Mesa Dr, and Camelback Rd	178.5	181	mi	2.5	$594,000	$90,000	$300,000	$0	$2,970,000	$3,360,000
				Install raised concrete barrier median on Gila River Bridge and approaches	178	178.5	mi	0.5	$1,430,000	$20,000	$70,000	$0	$715,000	$805,000
									Solution Total	**$113,000**	**$376,000**	**$0**	**$3,753,300**	**$4,242,300**
CS87.2	L3/L4	Bush Highway Area Safety and Freight Improvements	M	Rehabilitate shoulders	194	205	mi	11	$249,000	$160,000	$550,000	$0	$5,478,000	$6,188,000
				Install speed feedback signs	-	-	each	4	$55,000	$10,000	$20,000	$0	$220,000	$250,000
				Widen inside shoulder	209	211	mi	2	$159,000	$10,000	$30,000	$0	$318,000	$358,000
									Solution Total	**$180,000**	**$600,000**	**$0**	**$6,016,000**	**$6,796,000**
CS87.3	L6/L7	Sunflower Area Safety Improvements	M	Install speed feedback signs	-	-	each	12	$55,000	$20,000	$70,000	$0	$660,000	$750,000
				Install speed advisory warning signs with flashing beacons	-	-	each	12	$33,000	$10,000	$40,000	$0	$396,000	$446,000
				Rehabilitate shoulders	213	235	mi	21	$249,000	$310,000	$1,050,000	$0	$10,458,000	$11,818,000
				Widen inside shoulder	226	228.5	mi	2.5	$138,000	$10,000	$30,000	$0	$345,000	$385,000
				Install rock-fall mitigation	varies		mi	1.5	$2,904,000	$130,000	$440,000	$0	$4,356,000	$4,926,000
									Solution Total	**$480,000**	**$1,630,000**	**$0**	**$16,215,000**	**$18,325,000**
CS87.4	L8	Sunflower Area Freight Improvements	M	Construct NB climbing lane	213	215	mi	2	$4,950,000	$300,000	$990,000	$1,520,000	$9,900,000	$12,710,000
				Construct NB climbing lane	219	223	mi	4	$4,950,000	$700,000	$2,330,000	$3,040,000	$23,258,910	$29,328,910
									Solution Total	**$1,000,000**	**$3,320,000**	**$4,560,000**	**$33,158,910**	**$42,038,910**
CS87.5	L9	Slate Creek Pavement Improvements	M	Replace pavement	224	226	mi	1	$3,180,000	$190,000	$640,000	$0	$6,360,000	$7,190,000
									Solution Total	**$190,000**	**$640,000**	**$0**	**$6,360,000**	**$7,190,000**
CS87.6	L10/L11	Rye Area Safety and Freight Improvements	M	Install advisory signs about approaching areas with intersections	-	-	each	8	$5,500	$1,000	$4,000	$0	$44,000	$49,000
				Install reduced speed advisory signs on SR 87	-	-	each	4	$5,500	$1,000	$2,000	$0	$22,000	$25,000
				Install speed feedback signs	-	-	each	2	$55,000	$3,000	$10,000	$0	$110,000	$123,000
				On SR 188 approaching SR 87 add flashing beacons to WB stop sign	-	-	each	1	$22,000	$1,000	$2,000	$0	$22,000	$25,000
									Solution Total	**$6,000**	**$18,000**	**$0**	**$198,000**	**$222,000**
CS87.7	L13	Ox Bow Estates Area Safety Improvements	M	Install speed feedback signs	-	-	each	2	$55,000	$3,000	$10,000	$0	$110,000	$123,000
				Install speed advisory warning signs with flashing beacons	-	-	each	2	$33,000	$2,000	$10,000	$0	$66,000	$78,000
				Implement variable speed limit signs	241	246	mi	5	$194,500	$60,000	$190,000	$0	$1,945,000	$2,195,000

Candidate Solution #	Location #	Candidate Solution Name	Investment Category (Preservation [P], Modernization [M], Expansion [E])	Scope	BMP	EMP	Unit	Quantity	Factored Construction Unit Cost	Preliminary Engineering Cost	Design Cost	Right-of-Way Cost (assuming $12/sf)	Construction Cost	Total Cost
				Install new DMS	-	-	each	2	$550,000	$30,000	$110,000	$0	$1,100,000	$1,240,000
				Install new CCTV	-	-	each	2	$55,000	$3,000	$10,000	$0	$110,000	$123,000
				Install dynamic weather warning beacons	-	-	each	2	$88,000	$10,000	$20,000	$0	$176,000	$206,000
				Install RWIS	-	-	each	1	$132,000	$4,000	$10,000	$0	$132,000	$146,000
									Solution Total	**$112,000**	**$360,000**	**$0**	**$3,639,000**	**$4,111,000**
CS87.8	L12	Ox Bow Estates Area Freight Improvements	M	Construct NB climbing lane	243	247	mi	4	$4,950,000	$590,000	$1,980,000	$3,040,000	$19,800,000	$25,410,000
									Solution Total	**$590,000**	**$1,980,000**	**$3,040,000**	**$19,800,000**	**$25,410,000**
CS87.9	L14	Mazatzal Area Safety Improvements	M	Widen Shoulders SB	246.2	250.9	mi	4.7	$430,000	$60,000	$200,000	$0	$2,021,000	$2,281,000
									Solution Total	**$60,000**	**$200,000**	**$0**	**$2,021,000**	**$2,281,000**
CS260.10	L15/L16	Payson Area Safety and Freight Improvements	M	Implement signal coordination for six signals in Payson urban area	-	-	each	1	$308,000	$10,000	$30,000	$0	$308,000	$348,000
				Implement protected/permitted left-turn phasing at SR 87/Manzanita Dr intersection	-	-	each	1	$16,500	$0	$2,000	$0	$16,500	$18,500
				Install advanced signal advisory sign with flashing beacons WB on SR 87 before Manzanita signal	-	-	each	1	$33,000	$1,000	$3,000	$0	$33,000	$37,000
									Option A: Solution Total	**$11,000**	**$35,000**	**$0**	**$357,500**	**$403,500**
				Reconstruct three signalized intersections as double-lane roundabouts	-	-	each	3	$3,960,000	$360,000	$1,190,000	$0	$11,880,000	$13,430,000
				Implement signal coordination for three signals in Payson urban area	-	-	each	1	$308,000	$10,000	$30,000	$0	$308,000	$348,000
									Option B: Solution Total	**$370,000**	**$1,220,000**	**$0**	**$12,188,000**	**$13,778,000**
CS260.11	L17/L18	Lion Springs Area Mobility and Freight Improvements	E	Reconstruct to 4-lane divided highway	256	260	mi	4	$6,600,000	$1,500,000	$5,000,000	$9,630,720	$33,869,280	$50,000,000
									Solution Total	**$1,500,000**	**$5,000,000**	**$9,630,720**	**$33,869,280**	**$50,000,000**
CS260.12	L19	Christopher Creek Area Freight Improvements	M	Install rock-fall mitigation	varies		mi	1.3	$2,904,000	$110,000	$380,000	$0	$3,775,200	$4,265,200
				Implement variable speed limit signs	272	277	mi	5	$194,500	$60,000	$190,000	$0	$1,945,000	$2,195,000
				Install new DMS	-	-	each	1	$550,000	$20,000	$60,000	$0	$550,000	$630,000
				Install new CCTV	-	-	each	1	$55,000	$2,000	$10,000	$0	$55,000	$67,000
									Solution Total	**$192,000**	**$640,000**	**$0**	**$6,325,200**	**$7,157,200**
CS260.13	L20	Mogollon Rim Area Freight Improvements	M	Install centerline rumble strips	277	282	mi	5	$6,000	$1,000	$3,000	$0	$30,000	$34,000
				Install rock-fall mitigation	varies		mi	1.9	$2,904,000	$170,000	$550,000	$0	$5,517,600	$6,237,600
				Install dynamic weather warning beacons	-	-	each	2	$88,000	$10,000	$20,000	$0	$176,000	$206,000
				Install RWIS	-	-	each	1	$132,000	$4,000	$10,000	$0	$132,000	$146,000

Candidate Solution #	Location #	Candidate Solution Name	Investment Category (Preservation [P], Modernization [M], Expansion [E])	Scope	BMP	EMP	Unit	Quantity	Factored Construction Unit Cost	Preliminary Engineering Cost	Design Cost	Right-of-Way Cost (assuming $12/sf)	Construction Cost	Total Cost
				Implement variable speed limit signs	277	282	mi	5	$194,500	$60,000	$190,000	$0	$1,945,000	$2,195,000
				Install new DMS	-	-	each	1	$550,000	$20,000	$60,000	$0	$550,000	$630,000
				Install new CCTV	-	-	each	1	$55,000	$2,000	$10,000	$0	$55,000	$67,000
									Solution Total	**$267,000**	**$843,000**	**$0**	**$8,405,600**	**$9,515,600**
CS260.14	L20	Mogollon Rim Area Climbing Lane	M	Construct EB climbing lane	277	280	mi	3	$4,950,000	$450,000	$1,490,000	$2,280,000	$14,850,000	$19,070,000
									Solution Total	**$450,000**	**$1,490,000**	**$2,280,000**	**$14,850,000**	**$19,070,000**
CS260.15	L21/L22	Forest Lakes Area Safety and Freight Improvements	M	Widen shoulders	282	304	mi	22	$562,000	$370,000	$1,240,000	$0	$12,364,000	$13,974,000
				Construct alternating passing lanes	282	304	mi	11	$3,300,000	$1,130,000	$3,760,000	$0	$37,620,000	$42,510,000
									Solution Total	**$1,500,000**	**$5,000,000**	**$0**	**$49,984,000**	**$56,484,000**
CS77.16	L29/L30	Holbrook Area Mobility and Freight Improvements	E	Construct new roadway connection between SR 377/SR 77 intersection and I-40/40B West TI west of Holbrook			mi	2.3	$6,600,000	$460,000	$1,530,000	$6,470,000	$15,312,500	$23,772,500
				Bridge over the Little Colorado River and RR			each	1	$56,410,800	$1,690,000	$5,640,000	$4,560,000	$56,410,800	$68,300,800
									Option A: Solution Total	**$2,150,000**	**$7,170,000**	**$11,030,000**	**$71,723,300**	**$92,073,300**
				Construct new roadway connection between US 180/SR 77 intersection and I-40/40B West TI west of Holbrook			mi	0.7	$6,600,000	$140,000	$480,000	$2,030,000	$4,812,500	$7,462,500
				Bridge over the Little Colorado River and RR			each	1	$56,410,800	$1,690,000	$5,640,000	$4,560,000	$56,410,800	$68,300,800
									Option B: Solution Total	**$1,830,000**	**$6,120,000**	**$6,590,000**	**$61,223,300**	**$75,763,300**
				Construct overpass at at-grade railroad crossing adjacent to existing SR 77 alignment			each	1	$36,586,400	$1,100,000	$3,660,000	$0	$36,586,400	$41,346,400
				Remove old Bridge			each	1	$4,495,400	$130,000	$450,000	$0	$4,495,400	$5,075,400
									Option C: Solution Total	**$1,230,000**	**$4,110,000**	**$0**	**$41,081,800**	**$46,421,800**

APPENDIX B: LIFE-CYCLE COST ANALYSIS

Pavement Life-Cycle Cost Analysis Worksheet

Project Details	
Project title	Slate Creek Pavement Improvements
Route	SR 87
Milepost begin	224
Milepost end	226

Existing Roadway Characteristics			
Surface type (Asphalt or Concrete)	=	Asphalt	<<Select from Pull-down List>>
# of directions of travel (1 = one-way; 2 = two-way)	=	2	
# of lanes (in one direction)	=	2	
Width of typical lane (ft)	=	12	
Left shoulder width (ft)	=	4	
Right shoulder width (ft)	=	10	
Total roadway analysis segment length (centerline miles)	=	1	
Current year	=	2016	
Elevation (> 4,000 ft or < 4,000 ft)?	=	> 4,000 ft	<<Select from Pull-down List>>
Roadway width (ft) [each direction lanes & shoulders]	=	38	
Total lane-miles [total traffic direction lanes & shoulders]	=	6.3	
Total square feet [total traffic direction lanes & shoulders]	=	401,280	
Total square yards [total traffic direction lanes & shoulders]	=	44,587	

LCCA Parameters		
Analysis period (years)	=	40
Year of net present value	=	2017
First year of improvements	=	2021
Discount rate (%) - low	=	3%
Discount rate (%) - high	=	7%

Design Alternatives (DA)

	Characteristics		Pavement Material Cost ($)		
Treatment Type	*Pavement Thickness*	*Typical Service Life (years)*	*Lane-miles*	*Square Feet*	*Square Yards*
Concrete Reconstruction	8"-12"	26-30	$350,000	$5.5	$50
Asphalt Reconstruction	8"-12"	22-26	$280,000	$4.4	$40
Concrete Medium Rehab	1"-3"	20-24	$75,000	$1.2	$11
Concrete Light Rehab	<1"	14-18	$50,000	$0.8	$7
Asphalt Medium Rehab	3"-8"	16-20	$105,000	$1.7	$15
Asphalt Light Rehab	<3"	10-14	$70,000	$1.1	$10

Reconstruction: Other Materials Cost Factor
1.60

Rehab: Other Materials Cost Factor
1.20

Total Cost Factor (e.g., includes design, mobilization, traffic control, contingency, etc.)
2.44

			Total Unit Cost ($) [includes material costs and indirect costs]			Total Bi-Directional Cost ($)
Treatment Type	Pavement Thickness	Typical Service Life (years)	Lane-miles	Square Feet	Square Yards	Total Cost
Concrete Reconstruction	8"-12"	26-30	$1,366,400	$21.6	$194	$8,653,867
Asphalt Reconstruction	8"-12"	22-26	$1,093,120	$17.3	$155	$6,923,093
Concrete Medium Rehab	1"-3"	20-24	$219,600	$3.5	$31	$1,390,800
Concrete Light Rehab	<1"	14-18	$146,400	$2.3	$21	$927,200
Asphalt Medium Rehab	3"-8"	16-20	$307,440	$4.9	$44	$1,947,120
Asphalt Light Rehab	<3"	10-14	$204,960	$3.2	$29	$1,298,080

Pavement Service Life, Intervals, and Sequence of Improvements

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Design Alternative	Typical Service Life Value	Typical Service Life Range	Average Historical Interval Value	Interval to Use in LCCA Before Reconstruction	Interval to Use in LCCA After Reconstruction
Concrete Reconstruction	28	26-30	0	-	14
Asphalt Reconstruction	24	22-26	0	-	12
Concrete Medium Rehab	22	20-24	0	11	11
Concrete Light Rehab	16	14-18	0	8	8
Asphalt Medium Rehab	18	16-20	5.5	5	9
Asphalt Light Rehab	12	10-14	0	3	6
None	0	0	-	-	-

Note: The typical service life values and ranges are determined based on the elevation of the roadway segment using the reference tables below. The typical service life values should be used as the intervals between improvements in the design alternatives except when historical frequency values are available based on the frequency and type of improvements in the past at this location. Historical frequency values should only be used if they are lower than the typical values and only up until reconstruction is implemented, after which typical service life values should be used.

Elevation Below 4000' (Desert Environment)		
Design Alternative	**Typical Service Life Value**	**Typical Service Life Range**
Concrete Reconstruction	32	30-34
Asphalt Reconstruction	28	26-30
Concrete Medium Rehab	26	24-28
Concrete Light Rehab	20	18-22
Asphalt Medium Rehab	22	20-24
Asphalt Light Rehab	16	14-18
None	0	0

Elevation Above 4000' (Mountain Environment)		
Design Alternative	**Typical Service Life Value**	**Typical Service Life Range**
Concrete Reconstruction	28	26-30
Asphalt Reconstruction	24	22-26
Concrete Medium Rehab	22	20-24
Concrete Light Rehab	16	14-18
Asphalt Medium Rehab	18	16-20
Asphalt Light Rehab	12	10-14
None	0	0

Assumed LCCA Sequence of Improvements Based on the Initial Design Alternative Improvement	
Concrete Reconstruction (CR):	CR, CLR, CMR, CLR, CR, CLR, CMR. . .
Asphalt Reconstruction (AR):	AR, ALR, AMR, ALR, AR, ALR, AMR. . .
Concrete Medium Rehab (CMR):	CMR, CLR, CR, CLR, CMR, CLR, CR. . .
Concrete Light Rehab (CLR):	CLR, CR, CLR, CMR, CLR, CR, CLR. . .
Asphalt Medium Rehab (AMR):	AMR, ALR, AR, ALR, AMR, ALR, AR. . .
Asphalt Light Rehab (ALR):	ALR, AR, ALR, AMR, ALR, AR, ALR. . .

Pavement Improvement Project History

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Year	Project Number	Tracs No.	Direction of Improvement	Treatment Type	Improvement Description	Thickness (inches)	Beg. MP	End MP	Length (miles)
2001	STP-053-1(31)	H2306 02 C	NB/SB	Asphalt Reconstruction	Initial construction of the new portion of the roadway (both directions)	-	-	-	-
				Asphalt Reconstruction	Aggregate Base	5	218	226	8
				Asphalt Reconstruction	Asphaltic Concrete	6	218	226	8
				Asphalt Reconstruction	ACFC with Asphaltic Rubber (AR-ACFC)	0.5	218	226	8
2006	087-B-NFA	H7055 01 C	SB	Asphalt Medium Rehab	Mill existing material	3.5	218	226	8
					Asphaltic Concrete	3	218	226	8
					AR-ACFC	0.5	218	226	8
2012	087 MA 218	H8272 01 C	NB/SB	Asphalt Medium Rehab	Mill existing material	3.5	218	226	8
					Asphaltic Concrete	3	218	226	8
					AR-ACFC	0.5	218	226	8

Interval between Improvements in Years	Treatment Type Options	Estimated Historical Interval Value
After Asphalt Reconstruction:	Concrete Reconstruction	
After Asphalt Medium Rehab: 5	Asphalt Reconstruction	
After Asphalt Medium Rehab: 6	Concrete Medium Rehab	
	Concrete Light Rehab	
	Asphalt Medium Rehab	5.5
	Asphalt Light Rehab	

Design Alternative # 1 - Concrete Reconstruction

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Concrete Reconstruction

Number of Years	Year	Concrete Reconstruction	Agency Cost ($)	Net Present Value @ 3%	Net Present Value @ 7%
0	2016	None	$0	$0	$0
1	2017	None	$0	$0	$0
2	2018	None	$0	$0	$0
3	2019	None	$0	$0	$0
4	2020	None	$0	$0	$0
5	2021	Concrete Reconstruction	$8,653,867	$7,688,848	$6,601,993
6	2022	None	$0	$0	$0
7	2023	None	$0	$0	$0
8	2024	None	$0	$0	$0
9	2025	None	$0	$0	$0
10	2026	None	$0	$0	$0
11	2027	None	$0	$0	$0
12	2028	None	$0	$0	$0
13	2029	None	$0	$0	$0
14	2030	None	$0	$0	$0
15	2031	None	$0	$0	$0
16	2032	None	$0	$0	$0
17	2033	None	$0	$0	$0
18	2034	None	$0	$0	$0
19	2035	Concrete Light Rehab	$927,200	$544,632	$274,325
20	2036	None	$0	$0	$0
21	2037	None	$0	$0	$0
22	2038	None	$0	$0	$0
23	2039	None	$0	$0	$0
24	2040	None	$0	$0	$0
25	2041	None	$0	$0	$0
26	2042	None	$0	$0	$0
27	2043	Concrete Medium Rehab	$1,390,800	$644,907	$239,489
28	2044	None	$0	$0	$0
29	2045	None	$0	$0	$0
30	2046	None	$0	$0	$0
31	2047	None	$0	$0	$0
32	2048	None	$0	$0	$0
33	2049	None	$0	$0	$0
34	2050	None	$0	$0	$0
35	2051	None	$0	$0	$0
36	2052	None	$0	$0	$0
37	2053	None	$0	$0	$0
38	2054	Concrete Light Rehab	$927,200	$310,596	$75,853
39	2055	None	$0	$0	$0
40	2056	None	$0	$0	$0
41	2057	None	$0	$0	$0
42	2058	None	$0	$0	$0
43	2059	None	$0	$0	$0
44	2060	None	$0	$0	$0
45	2061	None	$0	$0	$0
Pick Last Used DA treatment type to calculate Remaining Service Life ››		Concrete Light Rehab	$521,550	$142,056	$26,571
Enter Year of Last Used DA Improvement ››		2054	Remaining Service Life Cost ^^		

	Net Present Value ($) @ 3%	Net Present Value ($) @ 7%
NET PRESENT VALUE	$9,046,928	$7,165,090
AGENCY COST	$11,377,517	

Design Alternative # 2 - Asphalt Reconstruction

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Enter Name of Design Alternative

Number of Years	Year	Asphalt Reconstruction	Agency Cost ($)	Net Present Value @ 3%	Net Present Value @ 7%
0	2016	None	$0	$0	$0
1	2017	None	$0	$0	$0
2	2018	None	$0	$0	$0
3	2019	None	$0	$0	$0
4	2020	None	$0	$0	$0
5	2021	Asphalt Reconstruction	$6,923,093	$6,151,079	$5,281,595
6	2022	None	$0	$0	$0
7	2023	None	$0	$0	$0
8	2024	None	$0	$0	$0
9	2025	None	$0	$0	$0
10	2026	None	$0	$0	$0
11	2027	None	$0	$0	$0
12	2028	None	$0	$0	$0
13	2029	None	$0	$0	$0
14	2030	None	$0	$0	$0
15	2031	None	$0	$0	$0
16	2032	None	$0	$0	$0
17	2033	Asphalt Light Rehab	$1,298,080	$808,921	$439,705
18	2034	None	$0	$0	$0
19	2035	None	$0	$0	$0
20	2036	None	$0	$0	$0
21	2037	None	$0	$0	$0
22	2038	None	$0	$0	$0
23	2039	Asphalt Medium Rehab	$1,947,120	$1,016,187	$439,491
24	2040	None	$0	$0	$0
25	2041	None	$0	$0	$0
26	2042	None	$0	$0	$0
27	2043	None	$0	$0	$0
28	2044	None	$0	$0	$0
29	2045	None	$0	$0	$0
30	2046	None	$0	$0	$0
31	2047	None	$0	$0	$0
32	2048	Asphalt Light Rehab	$1,298,080	$519,215	$159,369
33	2049	None	$0	$0	$0
34	2050	None	$0	$0	$0
35	2051	None	$0	$0	$0
36	2052	None	$0	$0	$0
37	2053	None	$0	$0	$0
38	2054	Asphalt Reconstruction	$6,923,093	$2,319,118	$566,370
39	2055	None	$0	$0	$0
40	2056	None	$0	$0	$0
41	2057	None	$0	$0	$0
42	2058	None	$0	$0	$0
43	2059	None	$0	$0	$0
44	2060	None	$0	$0	$0
45	2061	None	$0	$0	$0
Pick Last Used DA treatment type to calculate Remaining Service Life ››		Asphalt Reconstruction	$4,903,858	$1,335,672	$249,834
Enter Year of Last Used DA Improvement ››		2054	Remaining Service Life Cost ^^		

	Net Present Value ($) @ 3%	Net Present Value ($) @ 7%
NET PRESENT VALUE	$9,478,848	$6,636,695
AGENCY COST	$13,485,609	

Design Alternative # 3 - Asphalt Medium Rehab

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Enter Name of Design Alternative

Number of Years	Year	Asphalt Medium Rehab	Agency Cost ($)	Net Present Value @ 3%	Net Present Value @ 7%
0	2016	None	$0	$0	$0
1	2017	None	$0	$0	$0
2	2018	None	$0	$0	$0
3	2019	None	$0	$0	$0
4	2020	None	$0	$0	$0
5	2021	Asphalt Medium Rehab	$1,947,120	$1,729,991	$1,485,449
6	2022	None	$0	$0	$0
7	2023	None	$0	$0	$0
8	2024	None	$0	$0	$0
9	2025	None	$0	$0	$0
10	2026	Asphalt Light Rehab	$1,298,080	$994,870	$706,070
11	2027	None	$0	$0	$0
12	2028	None	$0	$0	$0
13	2029	Asphalt Reconstruction	$6,923,093	$4,855,718	$3,073,936
14	2030	None	$0	$0	$0
15	2031	None	$0	$0	$0
16	2032	None	$0	$0	$0
17	2033	None	$0	$0	$0
18	2034	None	$0	$0	$0
19	2035	None	$0	$0	$0
20	2036	None	$0	$0	$0
21	2037	None	$0	$0	$0
22	2038	None	$0	$0	$0
23	2039	None	$0	$0	$0
24	2040	None	$0	$0	$0
25	2041	Asphalt Light Rehab	$1,298,080	$638,569	$255,912
26	2042	None	$0	$0	$0
27	2043	None	$0	$0	$0
28	2044	None	$0	$0	$0
29	2045	None	$0	$0	$0
30	2046	None	$0	$0	$0
31	2047	Asphalt Medium Rehab	$1,947,120	$802,188	$255,788
32	2048	None	$0	$0	$0
33	2049	None	$0	$0	$0
34	2050	None	$0	$0	$0
35	2051	None	$0	$0	$0
36	2052	None	$0	$0	$0
37	2053	None	$0	$0	$0
38	2054	None	$0	$0	$0
39	2055	None	$0	$0	$0
40	2056	Asphalt Light Rehab	$1,298,080	$409,873	$92,754
41	2057	None	$0	$0	$0
42	2058	None	$0	$0	$0
43	2059	None	$0	$0	$0
44	2060	None	$0	$0	$0
45	2061	None	$0	$0	$0
Pick Last Used DA treatment type to calculate Remaining Service Life ››		Asphalt Light Rehab	$757,213	$206,244	$38,577
Enter Year of Last Used DA Improvement ››		2056	Remaining Service Life Cost ^^		

	Net Present Value ($) @ 3%	Net Present Value ($) @ 7%
NET PRESENT VALUE	$9,224,966	$5,831,331
AGENCY COST	$13,954,360	

Design Alternative # 4 - Asphalt Light Rehab

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Enter Name of Design Alternative

Number of Years	Year	Asphalt Light Rehab	Agency Cost ($)	Net Present Value @ 3%	Net Present Value @ 7%
0	2016	None	$0	$0	$0
1	2017	None	$0	$0	$0
2	2018	None	$0	$0	$0
3	2019	None	$0	$0	$0
4	2020	None	$0	$0	$0
5	2021	Asphalt Light Rehab	$1,298,080	$1,153,327	$990,299
6	2022	None	$0	$0	$0
7	2023	None	$0	$0	$0
8	2024	Asphalt Reconstruction	$6,923,093	$5,629,108	$4,311,355
9	2025	None	$0	$0	$0
10	2026	None	$0	$0	$0
11	2027	None	$0	$0	$0
12	2028	None	$0	$0	$0
13	2029	None	$0	$0	$0
14	2030	None	$0	$0	$0
15	2031	None	$0	$0	$0
16	2032	None	$0	$0	$0
17	2033	None	$0	$0	$0
18	2034	None	$0	$0	$0
19	2035	None	$0	$0	$0
20	2036	Asphalt Light Rehab	$1,298,080	$740,277	$358,930
21	2037	None	$0	$0	$0
22	2038	None	$0	$0	$0
23	2039	None	$0	$0	$0
24	2040	None	$0	$0	$0
25	2041	None	$0	$0	$0
26	2042	Asphalt Medium Rehab	$1,947,120	$929,955	$358,755
27	2043	None	$0	$0	$0
28	2044	None	$0	$0	$0
29	2045	None	$0	$0	$0
30	2046	None	$0	$0	$0
31	2047	None	$0	$0	$0
32	2048	None	$0	$0	$0
33	2049	None	$0	$0	$0
34	2050	None	$0	$0	$0
35	2051	Asphalt Light Rehab	$1,298,080	$475,156	$130,093
36	2052	None	$0	$0	$0
37	2053	None	$0	$0	$0
38	2054	None	$0	$0	$0
39	2055	None	$0	$0	$0
40	2056	None	$0	$0	$0
41	2057	Asphalt Reconstruction	$6,923,093	$2,122,322	$462,327
42	2058	None	$0	$0	$0
43	2059	None	$0	$0	$0
44	2060	None	$0	$0	$0
45	2061	None	$0	$0	$0
Pick Last Used DA treatment type to calculate Remaining Service Life ››		Asphalt Reconstruction	$5,769,244	$1,571,379	$293,922
Enter Year of Last Used DA Improvement ››		2057	Remaining Service Life Cost ^^		

	Net Present Value ($) @ 3%	Net Present Value ($) @ 7%
NET PRESENT VALUE	$9,478,766	$6,317,836
AGENCY COST	$13,918,302	

Summary of LCCA Results

SR 87 MP 224 - MP 226

	Concrete Reconstruction	Asphalt Reconstruction	Asphalt Medium Rehab	Asphalt Light Rehab
Net Present Value - 3%	$9,046,928	$9,478,848	$9,224,966	$9,478,766
Net Present Value - 7%	$7,165,090	$6,636,695	$5,831,331	$6,317,836
Agency Cost	$11,377,517	$13,485,609	$13,954,360	$13,918,302

Cost Ratio at 3% Discount Rate

0.98 Ratio of Concrete Reconstruction to Lowest Cost Rehab — 1.05

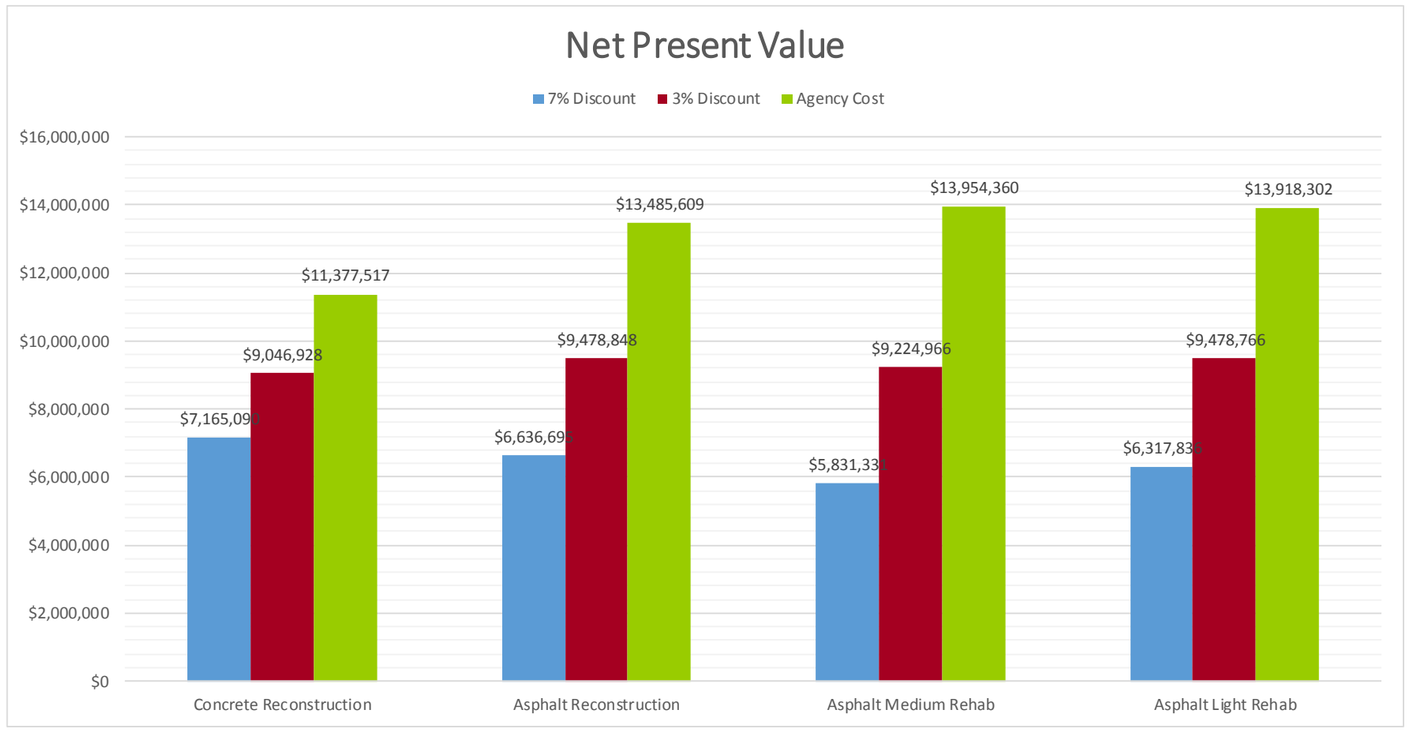
1.03 Ratio of Asphalt Reconstruction to Lowest Cost Rehab

Cost Ratio at 7% Discount Rate

1.23 Ratio of Concrete Reconstruction to Lowest Cost Rehab

1.14 Ratio of Asphalt Reconstruction to Lowest Cost Rehab

Note: A cost ratio < 1.15 means the Net Present Value (NPV) of reconstruction is within 15% of the NPV of the lowest cost rehab so reconstruction should likely be the initial improvement solution. A cost ratio > 1.15 means the NPV of reconstruction is more than 15% of the NPV of the lowest cost rehab so rehab should likely be the initial improvement solution.



SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF for Corridor Profile Studies	CMF Notes
REHABILITATION							
Rehabilitate Pavement (AC)	$276,500	Mile	2.20	$610,000	Mill and replace 1"-3" AC pvmt; accounts for 38' width; for one direction of travel on two lane roadway; includes pavement, striping, delineators, RPMs, rumble strips	0.70	Combination of rehabilitate pavement (0.92), striping, delineators, RPMs (0.77 for combination), and rumble strips (0.89) = 0.70
Rehabilitate Bridge	$65	SF	2.20	$140	Based on deck area; bridge only - no other costs included	0.95	Assumed - should have a minor effect on crashes at the bridge
GEOMETRIC IMPROVEMENT							
Re-profile Roadway	$974,500	Mile	2.20	$2,140,000	Includes excavation of approximately 3", pavement replacement (AC), striping, delineators, RPMs, rumble strips, for one direction of travel of 2-lane roadway (38' width)	0.70	Assumed - this is similar to rehab pavement. This solution is intended to address vertical clearance at bridge, not profile issue.
Realign Roadway	$2,960,000	Mile	2.20	$6,510,000	All costs per direction except bridges; applicable to areas with small or moderate fills and cuts, minimal retaining walls	0.50	Based on CalTrans and NC DOT
Improve Skid Resistance	$675,000	Mile	2.20	$1,490,000	Average cost of pvmt replacement and variable depth paving to increase super-elevation; for one direction of travel on two lane roadway; includes pavement, striping, delineators, RPMs, rumble strips	0.66	Combination of avg of 5 values from clearinghouse (0.77) and calculated value from HSM (0.87) for skid resistance; striping, delineators, RPMs (0.77 for combination), and rumble strips (0.89) = 0.66
INFRASTRUCTURE IMPROVEMENT							
Reconstruct to Urban Section	$1,000,000	Mile	2.20	$2,200,000	Includes widening by 16' total (AC = 12'+2'+2') to provide median, curb & gutter along both side of roadway, single curb for median, striping (doesn't include widening for additional travel lane).	0.88	From HSM
Construct Auxiliary Lanes (AC)	$914,000	Mile	2.20	$2,011,000	For addition of aux lane (AC) in one direction of travel; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.78	Average of 4 values from clearinghouse
Construct Climbing Lane (High)	$3,000,000	Mile	2.20	$6,600,000	In one direction; all costs except bridges; applicable to areas with large fills and cuts, retaining walls, rock blasting, steep slopes on both sides of road	0.75	From HSM
Construct Climbing Lane (Medium)	$2,250,000	Mile	2.20	$4,950,000	In one direction; all costs except bridges; applicable to areas with medium or large fills and cuts, retaining walls, rock blasting, steep slopes on one side of road	0.75	From HSM
Construct Climbing Lane (Low)	$1,500,000	Mile	2.20	$3,300,000	In one direction; all costs except bridges; applicable to areas with small or moderate fills and cuts, minimal retaining walls	0.75	From HSM
Construct Passing Lane	$1,500,000	Mile	2.20	$3,300,000	In one direction; all costs except bridges; applicable to areas with small or moderate fills and cuts, minimal retaining walls	0.63	Average of 3 values from clearinghouse
Construct Reversible Lane (Low)	$2,400,000	Lane-Mile	2.20	$5,280,000	All costs except bridges; applicable to areas with small or moderate fills and cuts, minimal retaining walls	0.73 for uphill and 0.88 for downhill	Based on proposed conditions on I-17 with 2 reversible lanes and a conc barrier
Construct Reversible Lane (High)	$4,800,000	Lane-Mile	2.20	$10,560,000	All costs except bridges; applicable to areas with large fills and cuts, retaining walls, rock blasting, mountainous terrain	0.73 for uphill and 0.88 for downhill	Based on proposed conditions on I-17 with 2 reversible lanes and a conc barrier

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF for Corridor Profile Studies	CMF Notes
Construct Entry/Exit Ramp	$730,000	Each	2.20	$1,610,000	Cost per ramp; includes pavement, striping, signing, RPMs, lighting, typical earthwork & drainage; does not include any major structures or improvements on crossroad	1.09	Average of 16 values on clearinghouse; for adding a ramp not reconstructing
Construct Turn Lanes	$170,000	Each	2.20	$374,000	Includes 14' roadway widening (AC) for one additional turn lane (250' long) on one leg of an intersection; includes AC pavement, curb & gutter, sidewalk, ramps, striping, and minor signal modifications	0.81	Avg of 7 values from HSM
Modify Entry/Exit Ramp	$445,000	Each	2.20	$979,000	Cost per ramp; includes pavement, striping, signing, RPMs, lighting, minor earthwork, & drainage; For converting existing ramp to parallel-type configuration	0.21	Average of 4 values from clearinghouse (for exit ramps) and equation from HSM (for entrance ramp)
Widen & Modify Entry/Exit Ramp	$619,000	Each	2.20	$1,361,800	Cost per ramp; includes pavement, striping, signing, RPMs, lighting, minor earthwork, & drainage; For converting 1-lane ramp to 2-lane ramp and converting to parallel-type ramp	0.21	Will be same as "Modify Ramp"
Replace Pavement (AC) (with overexcavation)	$1,446,500	Mile	2.20	$3,180,000	Accounts for 38' width; for one direction of travel on two lane roadway; includes pavement, overexcavation, striping, delineators, RPMs, rumble strips	0.70	Same as rehab
Replace Pavement (PCCP) (with overexcavation)	$1,736,500	Mile	2.20	$3,820,000	Accounts for 38' width; for one direction of travel on two lane roadway; includes pavement, overexcavation, striping, delineators, RPMs, rumble strips	0.70	Same as rehab
Replace Bridge	$125	SF	2.20	$280	Based on deck area; bridge only - no other costs included	0.95	Assumed - should have a minor effect on crashes at the bridge
Widen Bridge	$175	SF	2.20	$390	Based on deck area; bridge only - no other costs included	0.90	Assumed - should have a minor effect on crashes at the bridge
Install Pedestrian Bridge	$135	SF	2.20	$300	Includes cost to construct bridge based on linear feet of the bridge. This costs includes and assumes ramps and sidewalks leading to the structure.	0.1 (ped only)	Assumed direct access on both sides of structure
Implement Automated Bridge De-icing	$115	SF	2.20	$250	Includes cost to replace bridge deck and install system	0.72 (snow/ice)	Average of 3 values on clearinghouse for snow/ice
Install Wildlife Crossing Under Roadway	$650,000	Each	2.20	$1,430,000	Includes cost of structure for wildlife crossing under roadway	0.25 (wildlife)	Assumed
Install Wildlife Crossing Over Roadway	$1,140,000	Each	2.20	$2,508,000	Includes cost of structure for wildlife crossing over roadway	0.25 (wildlife)	Assumed
Construct Drainage Structure - Minor	$280,000	Each	2.20	$616,000	Includes 3-36" pipes and roadway reconstruction (approx. 1,000 ft) to install pipes	0.70	Same as rehab
Construct Drainage Structure - Intermediate	$540,000	Each	2.20	$1,188,000	Includes 5 barrel 8'x6' RCBC and roadway reconstruction (approx. 1,000 ft) to install RCBC	0.70	Same as rehab
Construct Drainage Structure - Major	$8,000	LF	2.20	$17,600	Includes bridge that is 40' wide and reconstruction of approx. 500' on each approach	0.70	Same as rehab
Install Center Turn Lane	$450,000	Mile	2.20	$990,000	Assumes widening (AC) of undivided facility to provide directional left-turn lane or two-way left-turn lane with associated transitions, signage and markings and standard shoulders; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.86	Average of 2 values from CMF Clearinghouse
OPERATIONAL IMPROVEMENT							
Implement Variable Speed Limits (Wireless, Overhead)	$718,900	Mile	2.20	$1,580,000	In one direction; includes 2 signs per mile (foundations and structures), wireless communication, detectors	0.92	From 1 value from clearinghouse

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF for Corridor Profile Studies	CMF Notes
Implement Variable Speed Limits (Wireless, Ground-mount)	$169,700	Mile	2.20	$373,300	In one direction; includes 2 signs per mile (foundations and posts), wireless communication, detectors	0.92	From 1 value from clearinghouse
Implement Variable Speed Limits (Wireless, Solar, Overhead)	$502,300	Mile	2.20	$1,110,000	In one direction; includes 2 signs per mile (foundations and structures), wireless communication, detectors, solar power	0.92	From 1 value from clearinghouse
Implement Variable Speed Limits (Wireless, Solar, Ground-mount)	$88,400	Mile	2.20	$194,500	In one direction; includes 2 signs per mile (foundations and posts), wireless communication, detectors, solar power	0.92	From 1 value from clearinghouse
Implement Ramp Metering (Low)	$25,000	Each	2.20	$55,000	For each entry ramp location; urban area with existing ITS backbone infrastructure; includes signals, poles, timer, pull boxes, etc.	0.64	From 1 value from clearinghouse
Implement Ramp Metering (High)	$150,000	Mile	2.20	$330,000	Area without existing ITS backbone infrastructure; in addition to ramp meters, also includes conduit, fiber optic lines, and power	0.64	From 1 value from clearinghouse
Implement Signal Coordination	$140,000	Mile	2.20	$308,000	Includes conduit, conductors, and controllers for 4 intersections that span a total of approximately 2 miles	0.90	Assumed
Implement Left-turn Phasing	$7,500	Each	2.20	$16,500	Includes four new signal heads (two in each direction) and associated conductors for one intersection	0.88 (protected) 0.98 (perm/prot or prot/perm)	From HSM; CMF = 0.94 for each protected approach and 0.99 for each perm/prot or prot/perm approach. CMFs of different approaches should be multiplied together
ROADSIDE DESIGN							
Install Guardrail	$130,000	Mile	2.20	$286,000	One side of road	0.62 (ROR)	0.62 is avg of 2 values from clearinghouse
Install Cable Barrier	$80,000	Mile	2.20	$176,000	In median	0.81	0.81 is average of 5 values from clearinghouse
Widen Shoulder (AC)	$256,000	Mile	2.20	$563,000	Assumes 10' of existing shoulder (combined left and right), includes widening shoulder by a total of 4'; new pavement for 4' width and mill and replace existing 10' width; includes pavement, minor earthwork, striping edge lines, RPMs, high-visibility delineators, and rumble strips	0.68 (1-4') 0.64 (>= 4')	0.86 is avg of 5 values from clearing house for widening shoulder 1-4'. 0.76 is calculated from HSM for widening shoulder >= 4'. (Cost needs to be updated if dimension of existing and widened shoulder differ from Description.)
Rehabilitate Shoulder (AC)	$113,000	Mile	2.20	$249,000	One direction of travel (14' total shldr width-4' left and 10' right); includes paving (mill and replace), striping, high-visibility delineators, RPMs, and rumble strips for both shoulders	0.72	0.98 is average of 34 values on clearinghouse for shldr rehab/replace; include striping, delineators, RPMs (0.77 combined CMF), and rumble strips (0.89). (Cost needs to be updated if dimension of existing shoulder differs from Description.)
Replace Shoulder (AC)	$364,000	Mile	2.20	$801,000	One direction of travel (14' total shldr width-4' left and 10' right); includes paving (full reconstruction), striping, high-visibility delineators, RPMs, and rumble strips for both shoulders	0.72	0.98 is average of 34 values on clearinghouse for shldr rehab/replace; include striping, delineators, RPMs (0.77 combined CMF), and rumble strips (0.89). (Cost needs to be updated if dimension of existing shoulder differs from Description.)
Install Rumble Strip	$5,500	Mile	2.20	$12,000	Both edges - one direction of travel; includes only rumble strip; no shoulder rehab or paving or striping	0.89	Average of 75 values on clearinghouse and consistent with HSM
Install Safety Edge	$80,000	Mile	2.20	$176,000		0.87	Average of 12 values on clearinghouse
Install Wildlife Fencing	$340,000	Mile	2.20	$748,000	Fencing only plus jump outs for 1 mile (both directions)	0.50 (wildlife)	Assumed

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF for Corridor Profile Studies	CMF Notes
Remove Tree/Vegetation	$200,000	Mile	2.20	$440,000	Removing trees that shade the roadway to allow sunlight to help melt snow and ice	0.72 (snow/ice)	Average of 3 values on clearinghouse for snow/ice
Install Centerline Rumble Strip	$2,800	Mile	2.20	$6,000	Includes rumble strip only; no pavement rehab or striping	0.85	From HSM
Install Access Barrier Fence	$15	LF	2.20	$33	8' fencing along residential section of roadway	0.1 (ped only)	Equal to ped overpass
Install Rock-Fall Mitigation - Wire Mesh	$1,320,000	Mile	2.20	$2,904,000	Includes wire mesh and rock stabilization (one direction)	0.75 (debris)	Assumed
Install Rock-Fall Mitigation - Containment Fence & Barrier	$2,112,000	Mile	2.20	$4,646,000	Includes containment fencing, concrete barrier, and rock stabilization (one direction)	0.75 (debris)	Assumed
Install Raised Concrete Barrier in Median	$650,000	Mile	2.20	$1,430,000	Includes concrete barrier with associated striping and reflective markings; excludes lighting in barrier (one direction)	0.90 (Cross-median and head on crashes eliminated completely)	All cross median and head-on fatal or incapacitating injury crashes are eliminated completely; all remaining crashes have 0.90 applied
Formalize Pullout (Small)	$7,400	Each	2.20	$16,000	Includes paving and advanced signage	0.80	Assumed
Formalize Pullout (Medium)	$27,400	Each	2.20	$60,000	Includes paving and advanced signage	0.80	Assumed
Formalize Pullout (Large)	$77,900	Each	2.20	$171,400	Includes paving and advanced signage	0.80	Assumed
INTERSECTION IMPROVEMENTS							
Construct Traffic Signal	$150,000	Each	2.20	$330,000	4-legged intersection; includes poles, foundations, conduit, controller, heads, luminaires, mast arms, etc.	0.95	From HSM
Improve Signal Visibility	$35,000	Each	2.20	$77,000	4-legged intersection; signal head size upgrade, installation of new back-plates, and installation of additional signal heads on new poles.	0.85	Avg of 7 values from clearinghouse.
Install Raised Median	$360,000	Mile	2.20	$792,000	Includes removal of 14' wide pavement and construction of curb & gutter; does not include cost to widen roadway to accommodate the median; if the roadway needs to be widened, include cost from New General Purpose Lane	0.83	Avg from HSM
Install Transverse Rumble Strip/Pavement Markings	$3,000		2.20	$7,000	Includes ped markings and rumble strips only across a 30' wide travelway; no pavement rehab or other striping	0.95	Avg of 17 values from clearinghouse.
Construct Single-Lane Roundabout	$1,500,000	Each	2.20	$3,300,000	Removal of signal at 4-legged intersection; realignment of each leg for approx. 800 feet including paving, curbs, sidewalk, striping, lighting, signing	0.22	From HSM
Construct Double-Lane Roundabout	$1,800,000	Each	2.20	$3,960,000	Removal of signal at 4-legged intersection; realignment of each leg for approx. 800 feet including paving, curbs, sidewalk, striping, lighting, signing	0.40	From HSM
ROADWAY DELINEATION							
Install High-Visibility Edge Line Striping	$10,800	Mile	2.20	$23,800	2 edge lines and lane line - one direction of travel	0.77	Avg of 3 values from clearinghouse. Assumes package of striping, delineators, and RPMs. (If implemented separately, CMF will be higher.)
Install High-Visibility Delineators	$6,500	Mile	2.20	$14,300	Both edges - one direction of travel		Avg of 3 values from clearinghouse. Assumes package of striping, delineators, and RPMs. (If implemented separately, CMF will be higher.)

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF for Corridor Profile Studies	CMF Notes
Install Raised Pavement Markers	$2,000	Mile	2.20	$4,400	Both edges - one direction of travel		Avg of 3 values from clearinghouse. Assumes package of striping, delineators, and RPMs. (If implemented separately, CMF will be higher.)
Install In-Lane Route Markings	$6,000	Each	2.20	$13,200	Installation of a series of three in-lane route markings in one lane	0.95	Assumed
IMPROVED VISIBILITY							
Cut Side Slopes	$80	LF	2.20	$200	For small grading to correct sight distance issues; not major grading	0.85	Intent of this solution is to improve sight distance. Most CMF's are associated with vehicles traveling on slope. Recommended CMF is based on FDOT and NCDOT but is more conservative.
Install Lighting (connect to existing power)	$270,000	Mile	2.20	$594,000	One side of road only; offset lighting, not high-mast; does not include power supply; includes poles, luminaire, pull boxes, conduit, conductor	0.75 (night)	Average of 3 values on clearinghouse & consistent with HSM
Install Lighting (solar powered LED)	$10,000	Pole	2.20	$22,000	Offset lighting, not high-mast; solar power LED; includes poles, luminaire, solar panel	0.75 (night)	Average of 3 values on clearinghouse & consistent with HSM
DRIVER INFORMATION/WARNING							
Install Dynamic Message Sign (DMS)	$250,000	Each	2.20	$550,000	Includes sign, overhead structure, and foundations; wireless communication; does not include power supply	1.00	Not expected to reduce crashes
Install Dynamic Weather Warning Beacons	$40,000	Each	2.20	$88,000	Assumes solar operation and wireless communication or connection to existing power and communication; ground mounted; includes posts, foundations, solar panel, and dynamic sign	0.80 (weather related)	Avg of 3 values from FHWA Desktop Reference for installing pavement condition warning signs
Install Dynamic Speed Feedback Signs	$25,000	Each	2.20	$55,000	Assumes solar operation and no communication; ground mounted; includes regulatory sign, posts, foundations, solar panel, and dynamic sign	0.94	Average of 2 clearinghouse values
Install Chevrons	$18,400	Mile	2.20	$40,500	On one side of road - includes signs, posts, and foundations	0.79	Average of 11 values on clearinghouse
Install Curve Warning Signs	$2,500	Each	2.20	$5,500	Includes 2 signs, posts, and foundations	0.83	Average of 4 clearinghouse values
Install Traffic Control Device Warning Signs (e.g., stop sign ahead, signal ahead, etc.)	$2,500	Each	2.20	$5,500	Includes 2 signs, posts, and foundations	0.85	FHWA Desktop Reference
Install Other General Warning Signs (e.g., intersection ahead, wildlife in area, slow vehicles, etc.)	$2,500	Each	2.20	$5,500	Includes 2 signs, posts, and foundations	0.97	Assumed
Install Wildlife Warning System	$162,000	Each	2.20	$356,400	Includes wildlife detection system, flashing warning signs (assumes solar power), advance signing, CCTV (solar and wireless), and fencing for approximately 2 miles in each direction	0.50 (wildlife)	Assumed
Install Warning Sign with Beacons	$15,000	Each	2.20	$33,000	In both directions; includes warning sign, post, and foundation, and flashing beacons (assumes solar power) at one location	0.75	FHWA Desktop Reference for Installing Flashing Beacons as Advance Warning
Install Larger Stop Sign with Beacons	$10,000	Each	2.20	$22,000	In one direction; includes large stop sign, post, and foundation, and flashing beacons (assumes solar power) at one location	0.85/0.81	Use 0.85 for adding beacons to an existing sign; 0.81 for installing a larger sign with flashing beacons

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF for Corridor Profile Studies	CMF Notes
DATA COLLECTION							
Install Roadside Weather Information System (RWIS)	$60,000	Each	2.20	$132,000	Assumes wireless communication and solar power, or connection to existing power and communications	1.00	Not expected to reduce crashes
Install Closed Circuit Television (CCTV) Camera	$25,000	Each	2.20	$55,000	Assumes connection to existing ITS backbone or wireless communication; does not include fiber-optic backbone infrastructure; includes pole, camera, etc.	1.00	Not expected to reduce crashes
Install Vehicle Detection Stations	$15,000	Each	2.20	$33,000	Assumes wireless communication and solar power, or connection to existing power and communications	1.00	Not expected to reduce crashes
Install Flood Sensors (Activation)	$15,000	Each	2.20	$33,000	Sensors with activation cabinet to alert through texting (agency)	1.00	Not expected to reduce crashes
Install Flood Sensors (Gates)	$100,000	Each	2.20	$220,000	Sensors with activation cabinet to alert through texting (agency) and beacons (public) plus gates	1.00	Not expected to reduce crashes
WIDEN CORRIDOR							
Construct New General Purpose Lane (PCCP)	$1,740,000	Mile	2.20	$3,830,000	For addition of 1 GP lane (PCCP) in one direction; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.90	North Carolina DOT uses 0.90 and Florida DOT uses 0.87
Construct New General Purpose Lane (AC)	$1,200,000	Mile	2.20	$2,640,000	For addition of 1 GP lane (AC) in one direction; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.90	North Carolina DOT uses 0.90 and Florida DOT uses 0.88
Convert a 2-lane undivided highway to a 5-lane highway	$1,576,000	Mile	2.20	$3,467,200	For expanding a 2-lane undivided highway to a 5-lane highway (4 through lanes with TWLTL), includes standard shoulder widths but no curb, gutter, or sidewalks	0.70	Assumed to be slightly lower than converting from a 4-lane to a 5-lane highway
Convert a 4-lane undivided highway to a 5-lane highway	$1,053,000	Mile	2.20	$2,316,600	For expanding a 4-lane undivided highway to a 5-lane highway (4 through lanes with TWLTL), includes standard shoulder widths but no curb, gutter, or sidewalk	0.75	From FHWA Desktop Reference for CRFs, CMF Clearinghouse, and SR 87 CPS comparison
Construct 4-lane Divided Highway (Using Existing 2-lane Road for one direction)	$3,000,000	Mile	2.20	$6,600,000	In both directions; one direction uses existing 2-lane road; other direction assumes addition of 2 new lanes (AC) with standard shoulders; includes all costs except bridges	0.67	Assumed
Construct 4-lane Divided Highway (No Use of Existing Roads)	$6,000,000	Mile	2.20	$13,200,000	In both directions; assumes addition of 2 new lanes (AC) with standard shoulders in each direction; includes all costs except bridges	0.67	Assumed
Construct Bridge over At-Grade Railroad Crossing	$10,000,000	Each	2.20	$22,000,000	Assumes bridge width of 4 lanes (AC) with standard shoulders; includes abutments and bridge approaches; assumes vertical clearance of 23'4" + 6'8" superstructure	0.72 (All train-related crashes eliminated)	Removes all train-related crashes at at-grade crossing; all other crashes CMF = 0.72
Construct Underpass at At-Grade Railroad Crossing	$15,000,000	Each	2.20	$33,000,000	Assumes underpass width of 4 lanes (AC) with standard shoulders; includes railroad bridge with abutments and underpass approaches; assumes vertical clearance of 16'6" + 6'6" superstructure	0.72 (All train-related crashes eliminated)	Removes all train-related crashes at at-grade crossing; all other crashes CMF = 0.72
Construct High-Occupancy Vehicle (HOV) Lane	$900,000	Mile	2.20	$1,980,000	For addition of 1 HOV lane (AC) in one direction with associated signage and markings; includes all costs except bridges; for generally at-grade facility with minimal walls and no major drainage improvements	0.95	Similar to general purpose lane

SOLUTION	CONSTRUCTION UNIT COST	UNIT	FACTOR^	FACTORED CONSTRUCTION UNIT COST	DESCRIPTION	CMF for Corridor Profile Studies	CMF Notes
ALTERNATE ROUTE							
Construct Frontage Roads	$2,400,000	Mile	2.20	$5,280,000	For 2-lane AC frontage road; includes all costs except bridges; for generally at-grade facility with minimal walls	0.90	Assumed - similar to new general purpose lane
Construct 2-lane Undivided Highway	$3,000,000	Mile	2.20	$6,600,000	In both directions; assumes addition of 2 new lanes (AC) with standard shoulders in each direction; includes all costs except bridges	0.90	Assuming new alignment for a bypass

APPENDIX D: PERFORMANCE AREA RISK FACTORS

Pavement Performance Area

- Mainline Daily Traffic Volume
- Mainline Daily Truck Volume
- Elevation
- Interrupted Flow

Elevation

Variance above 4000' divided by 1000; (Elev-4000)/1000

Score	Condition
0	< 4000’
0-5	4000’- 9000’
5	> 9000’

Mainline Daily Traffic Volume

Exponential equation; score = 5-(5*e$^{(ADT*-0.000039)}$)

Score	Condition
0	< 6,000
0-5	6,000 – 160,000
5	>160,000

Mainline Daily Truck Volume

Exponential equation; score = 5-(5*e$^{(ADT*-0.00025)}$)

Score	Condition
0	<900
0-5	900-25,000
5	>25,000

Interrupted Flow

Score	Condition
0	Not interrupted flow
5	Interrupted Flow

Bridge Performance Area

- Mainline Daily Traffic Volume
- Detour Length
- Elevation
- Scour Critical Rating
- Carries Mainline Traffic
- Vertical Clearance

Mainline Daily Traffic Volume

Exponential equation; score = 5-(5*e$^{(ADT*-0.000039)}$)

Score	Condition
0	<6,000
0-5	6,000-160,000
5	>160,000

Elevation

Variance above 4000' divided by 1000; (Elev-4000)/1000

Score	Condition
0	< 4000’
0-5	4000’- 9000’
5	> 9000’

Carries Mainline

Score	Condition
0	Does not carry mainline traffic
5	Carries mainline traffic

Detour Scale

Divides detour length by 10 and multiplies by 2.5

Score	Condition
0	0 miles
0-5	0-20 miles
5	> 20 miles

Scour

Variance below 8

Score	Condition
0	Rating > 8
0-5	Rating 8 - 3
5	Rating < 3

Vertical Clearance

Variance below 16’ x 2.5; (16 –Clearance) x 2.5

Score	Condition
0	>16’
0-5	16’-14’
5	<14’

Mobility Performance Area

- Mainline VMT
- Detour Length
- Buffer Index (PTI-TTI)
- Shoulder Width

Mainline VMT

Exponential equation; score = 5-(5*e$^{(ADT*-0.0000139)}$)

Score	Condition
0	<16,000
0-5	16,000-400,000
5	>400,000

Buffer Index

Buffer Index x 10

Score	Condition
0	Buffer Index = 0.00
0-5	Buffer Index 0.00-0.50
5	Buffer Index > 0.50

Detour Length

Score	Condition
0	Detour < 10 miles
5	Detour > 10 miles

Shoulder Width

Variance below 10', if only 1 lane in each direction

Score	Condition
0	10' or above or >1 lane in each direction
0-5	10'-5' and 1 lane in each direction
5	5' or less and 1 lane in each direction

Safety Performance Area

- Mainline Daily Traffic Volume
- Vertical Grade
- Shoulder width (Right)
- Elevation
- Interrupted Flow

Mainline Daily Traffic Volume

Exponential equation; score = 5-(5*e$^{(ADT*-0.000039)}$)

Score	Condition
0	<6,000
0-5	6,000-160,000
5	>160,000

Interrupted Flow

Score	Condition
0	Not interrupted flow
5	Interrupted Flow

Elevation

Variance above 4000' divided by 1000; (Elev-4000)/1000

Score	Condition
0	< 4000'
0-5	4000'- 9000'
5	> 9000'

Shoulder Right side)

Variance below 10'

Score	Condition
0	10' or above
0-5	10' - 5'
5	5' or less

Grade

Variance above 3% x 1.5

Score	Condition
0	< 3%
0-5	3% - 6.33%
5	>6.33%

Freight Performance Area

- Mainline Daily Truck Volume
- Detour Length
- Truck Buffer Index (TPTI-TTTI)
- Shoulder Width

Mainline Daily Truck Volume

Exponential equation; score = 5-(5*e$^{(ADT*-0.00025)}$)

Score	Condition
0	<900
0-5	900-25,000
5	>25,000

Detour Length

Score	Condition
0	Detour < 10 miles
5	Detour > 10 miles

Truck Buffer Index

Truck Buffer Index x 10

Score	Condition
0	Buffer Index = 0.00
0-5	Buffer Index 0.00-0.50
5	Buffer Index > 0.50

Shoulder Width

Variance below 10', if only 1 lane in each direction

Score	Condition
0	10' or above or >1 lane in each direction
0-5	10'-5' and 1 lane in each direction
5	5' or less and 1 lane in each direction

Solution Number	Mainline Traffic Vol (vpd) (2-way)	Solution Length (miles)	Bridge Detour Length (miles) (N19)	Elevation (ft)	Scour Critical Rating (0-9)	Carries Mainline Traffic (Y/N)	Bridge Vert. Clear (ft)	Mainline Truck Vol (vpd) (2-way)	Detour Length > 10 miles (Y/N)	Truck Buffer Index	Non-Truck Buffer Index	Grade (%)	Interrupted Flow (Y/N)	Outside/ Right Shoulder Width (ft)	1-lane each direction
87.1	15,116	1.6		1,250				693	N	2.43	2.39	1.4	Y	6.97	N
87.2	9,827	10.0		2,100				983	Y	0.70	0.46	3.9	N	9.42	N
87.3	10,778	21.0		3,600				1,072	Y	0.71	0.65	6.0	N	9.29	N
87.4	10,778	6.0		3,650				1,072	Y	0.71	0.65	8.3	N	9.29	N
87.5B - Replace Pavement	10,778	6.0		3,600				1,072	Y	0.71	0.65	6.5	N	9.29	N
87.6	11,717	2.3		3,100				1,200	Y	0.63	0.42	2.5	N	9.86	N
87.7	11,717	5.0		4,200				1,200	Y	0.88	0.93	5.6	N	7.52	N
87.8	11,717	4.0		4,150				1,200	Y	0.88	0.93	9.0	N	7.52	N
87.9	11,717	4.7		4,700				1,200	Y	0.88	0.93	4.7	N	7.52	N
260.10-1 (87 Portion)	19,185	1.6		4,935				1,609	N	2.03	3.93	1.5	Y	5.82	N
260.10-2 (260 Portion)	14,233	0.4		4,960				289	N	5.46	4.79	2.0	Y	4.62	N
260.11	13,796	4.0		4,900				242	Y	1.05	0.33	3.6	N	1.21	Y
260.12	6,270	6.2		5,900				241	Y	0.54	0.43	6.8	N	9.53	N
260.13	6,112	5.0		6,800				391	Y	0.63	0.53	6.4	N	5.19	N
260.14	6,112	3.0		6,800				391	Y	0.63	0.53	6.4	N	5.19	N
260.15	5,954	22.0		7,300				533	Y	0.39	0.24	2.0	N	2.26	Y
77.16A (SR 377/SR 77 connection)	7,694	2.3	26	5,100	8	Y	20.00	1,020	Y	3.26	4.03	1.0	Y	1.49	Y
77.16B (US 180/SR 77 connection)	7,694	0.8	26	5,100	8	Y	20.00	1,020	Y	3.26	4.03	1.0	Y	1.49	Y
77.16C (adjacent to SR 77)	7,694	0.6	26	5,100	8	Y	20.00	1,020	Y	3.26	4.03	1.0	Y	1.49	Y

Solution Number	Bridge	Pavement	Mobility	Safety	Freight	Risk Score (0 to 10)				
						Bridge	Pavement	Mobility	Safety	Freight
87.1	N	N	Y	Y	Y	0.00	0.00	1.63	4.10	1.34
87.2	N	N	Y	Y	Y	0.00	0.00	6.68	1.40	5.55
87.3	N	N	Y	Y	Y	0.00	0.00	7.39	2.77	5.59
87.4	N	N	Y	Y	Y	0.00	0.00	6.48	2.97	5.59
87.5B - Replace Pavement	N	Y	Y	Y	Y	0.00	1.92	6.48	2.97	5.59
87.6	N	N	Y	Y	Y	0.00	0.00	5.37	0.78	5.65
87.7	N	N	Y	Y	Y	0.00	0.00	6.39	3.36	5.65
87.8	N	N	Y	Y	Y	0.00	0.00	6.20	3.78	5.65
87.9	N	N	Y	Y	Y	0.00	0.00	6.34	3.02	5.65
260.10-1 (87 Portion)	N	N	Y	Y	Y	0.00	0.00	2.39	5.09	1.61
260.10-2 (260 Portion)	N	N	Y	Y	Y	0.00	0.00	2.03	5.23	2.28
260.11	N	N	Y	Y	Y	0.00	0.00	7.98	3.55	7.65
260.12	N	N	Y	Y	Y	0.00	0.00	5.67	3.38	5.15
260.13	N	N	Y	Y	Y	0.00	0.00	5.86	5.46	5.23
260.14	N	N	Y	Y	Y	0.00	0.00	5.56	5.46	5.23
260.15	N	N	Y	Y	Y	0.00	0.00	8.30	3.73	7.27
77.16A (SR 377/SR 77 connection)	Y	Y	Y	Y	Y	4.13	2.34	7.10	4.95	6.82
77.16B (US 180/SR 77 connection)	Y	Y	Y	Y	Y	4.13	2.34	6.76	4.95	6.82
77.16C (adjacent to SR 77)	Y	Y	Y	Y	Y	4.13	2.34	6.71	4.95	6.82

APPENDIX E: PERFORMANCE EFFECTIVENESS SCORES

		Solution #	87.1	87.2	87.3	87.4	87.5	87.6	87.7	87.8	87.9	260.10A-1 (87 Portion)	260.10A-2 (260 Portion)	260.10B-1 (87 Portion)	260.10B-2 (260 Portion)	260.11	260.12	260.13	260.14	260.15	77.16A	77.16B	77.16C
		Description	Gila River Area Safety Improvements	Bush Highway Area Safety and Freight Improvements	Sunflower Area Safety Improvements	Sunflower Area Freight Improvements	Slate Creek Pavement Improvements (Replace)	Rye Area Safety and Freight Improvements	Ox Bow Estates Area Safety Improvements	Ox Bow Estates Area Freight Improvements	Mazatzal Area Safety Improvements	Payson Area Safety and Freight Improvements	Payson Area Safety and Freight Improvements	Payson Area Safety and Freight Improvements	Payson Area Safety and Freight Improvements	Lion Springs Area Mobility and Freight Improvements	Christopher Creek Area Freight Improvements	Mogollon Rim Area Freight Improvements	Mogollon Rim Area Climbing Lane	Forest Lakes Area Safety and Freight Improvements	Holbrook Area Mobility and Freight Improvements (SR 377/SR 77 connection)	Holbrook Area Mobility and Freight Improvements (US 180/SR 77 connection)	Holbrook Area Mobility and Freight Improvements (adjacent to SR 77)
		Project Beg MP	177	191	213	213	224	235	241	243	246	251	252	251	252	256	260	277	277	282	386	386	386
		Project End MP	182	213	235	219	226	241	250	247	251	253	253	253	253	260	277	282	280	304	389	389	389
		Project Length (miles)	3	10	21	6	1	3.8	5	4	4.7	2	1	2	1	4	6.2	5	3	22	2.3	0.8	0.6
		Segment Beg MP	177	191	213	213	213	235	241	241	241	250	252	250	252	256	260	277	277	282	386	386	386
		Segment End MP	182	213	235	235	235	241	250	250	250	253	256	253	256	260	277	282	282	304	389	389	389
		Segment Length (miles)	5	22	22	22	22	6	9	9	9	3	4	3	4	4	17	5	5	22	3.6	1.6	0.6
		Segment #	1	3	4	4	4	5	6	6	6	7	8	7	8	9	10	11	11	12	16	16	16
		Current # of Lanes (both directions)	4	4	4	4	4	4	4	4	4	4	4	4	4	2	4	4	4	2	2	2	2
		Project Type (one-way or two-way)	two-way	two-way	two-way	one-way	two-way	two-way	two-way	one-way	one-way	two-way	two-way	two-way	two-way	two-way	two-way	two-way	one-way	two-way	two-way	two-way	two-way
		Additional Lanes (one-way)	0	0	0	1	0	0	0	1	0	0	0	0	0	2	0	0	1	0.25	2	2	0
		Pro-Rated # of Lanes	4.00	4.00	4.00	4.27	4.00	4.00	4.00	4.44	4.00	4.00	4.00	4.00	4.00	6.00	4.00	4.00	4.60	2.50	4.56	4.00	2.00
		Description																					
SAFETY	DIRECTIONAL SAFETY	Orig Segment Directional Safety Index (direction 1)	4.046	0.475	1.482	1.482	1.482	0.081	0.088	0.088	0.088	2.480	0.559	2.480	0.559	0.198	0.622	0.159	0.159	2.246	8.784	8.784	8.784
		Orig Segment Directional Fatal Crashes (direction 1)	4	1	4	4	4	0	0	0	0	1	0	1	0	0	1	0	0	4	2	2	2
		Orig Segment Directional Incap Crashes (direction 1)	1	8	11	11	11	1	2	2	2	1	7	1	7	1	2	1	1	5	0	0	0
		Original Fatal Crashes in project limits (direction 1)	4	1	4	3	1	0	0	0	0	1	0	1	0	0	0	0	0	4	2	2	2
		Original Incap Crashes in project limits (direction 1)	1	7	11	6	3	1	2	1	0	1	3	1	2	1	0	1	0	5	0	0	0
		CMF 1 (direction 1)(lowest CMF)	1	1	1	0.75	0.7	0.94	1	0.75	1	1	1	1	1	0.67	1	0.85	0.75	1	1	1	1
		CMF 2 (direction 1)	1	1	1	1	1	0.97	1	1	1	1	1	1	1	1	1	0.92	1	1	1	1	1
		CMF 3 (direction 1)	1	1	1	1	1	0.97	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		CMF 4 (direction 1)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		CMF 5 (direction 1)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Total CMF (direction 1)	1.000	1.000	1.000	0.750	0.700	0.912	1.000	0.750	1.000	1.000	1.000	1.000	1.000	0.670	1.000	0.816	0.750	1.000	1.000	1.000	1.000
		Fatal Crash reduction (direction 1)	1.743	0.060	1.300	0.750	0.300	0.000	0.000	0.000	0.000	0.100	0.000	0.100	0.000	0.000	0.000	0.000	0.000	1.934	0.000	0.000	2.000
		Incap Crash reduction (direction 1)	0.301	1.300	3.800	1.500	0.900	0.088	0.160	0.250	0.000	0.100	0.468	0.600	1.300	0.330	0.000	0.184	0.000	2.294	0.000	0.000	0.000
		Post-Project Segment Directional Fatal Crashes (direction 1)	2.257	0.940	2.700	3.250	3.700	0.000	0.000	0.000	0.000	0.900	0.000	0.900	0.000	0.000	1.000	0.000	0.000	2.066	2.000	2.000	0.000
		Post-Project Segment Directional Incap Crashes (direction 1)	0.699	6.700	7.200	9.500	10.100	0.912	1.840	1.750	2.000	0.900	6.532	0.400	5.700	0.670	2.000	0.816	1.000	2.706	0.000	0.000	0.000
		Post-Project Segment Directional Safety Index (direction 1)	2.292	0.429	0.996	1.216	1.370	0.074	0.081	0.077	0.882	2.230	0.521	2.150	0.455	0.132	0.622	0.130	0.159	1.165	8.784	8.784	0.000
		Post-Project Segment Directional Safety Index (direction 1)	2.292	0.429	0.996	1.216	1.370	0.074	0.081	0.077	0.088	2.230	0.521	2.150	0.455	0.132	0.622	0.130	0.159	1.165	8.784	8.784	0.000
		Orig Segment Directional Safety Index (direction 2)	1.983	1.902	1.759	1.759	1.759	2.361	4.132	4.132	4.132	0.160	0.000	0.160	0.000	3.069	1.239	0.479	0.479	0.622	4.370	4.370	4.370
		Orig Segment Directional Fatal Crashes (direction 2)	2	6	5	5	5	2	6	6	6	0	0	0	0	1	2	0	0	1	1	1	1
		Orig Segment Directional Incap Crashes (direction 2)	0	3	10	10	10	0	6	6	6	1	0	1	0	1	3	3	3	3	0	0	0
		Original Fatal Crashes in project limits (direction 2)	2	6	5	0	2	2	2	0	4	0	0	0	0	1	1	0	0	1	1	1	1
		Original Incap Crashes in project limits (direction 2)	0	2	10	0	4	0	4	0	1	1	0	1	0	1	3	3	0	3	0	0	0
		CMF 1 (direction 2)(lowest CMF)	1	1	1	1	0.7	0.85	1	1	0.64	1	1	1	1	0.67	0.92	0.85	1	1	1	1	1
		CMF 2 (direction 2)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.92	1	1	1	1	1
		CMF 3 (direction 2)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		CMF 4 (direction 2)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		CMF 5 (direction 2)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Total CMF (direction 2)	1.000	1.000	1.000	1.000	0.700	0.850	1.000	1.000	0.640	1.000	1.000	1.000	1.000	0.670	0.920	0.816	1.000	1.000	1.000	1.000	1.000
		Fatal Crash reduction (direction 2)	0.603	1.801	1.625	0.000	0.600	0.300	0.242	0.000	1.440	0.000	0.000	0.000	0.000	0.330	0.080	0.000	0.000	0.483	0.300	0.300	1.000
		Incap Crash reduction (direction 2)	0.000	0.620	3.430	0.000	1.200	0.000	0.484	0.000	0.360	0.100	0.000	0.100	0.000	0.330	0.240	0.552	0.000	1.203	0.000	0.000	0.000
		Post-Project Segment Directional Fatal Crashes (direction 2)	1.397	4.199	3.375	5.000	4.400	1.700	5.758	6.000	4.560	0.000	0.000	0.000	0.000	0.670	1.920	0.000	0.000	0.517	0.700	0.700	0.000
		Post-Project Segment Directional Incap Crashes (direction 2)	0.000	2.380	6.570	10.000	8.800	0.000	5.516	6.000	5.640	0.900	0.000	0.900	0.000	0.670	2.760	2.448	3.000	1.797	0.000	0.000	0.000
		Post-Project Segment Directional Safety Index (direction 2)	1.385	1.337	1.183	1.759	1.548	2.007	3.955	4.132	3.189	0.150	0.000	0.150	0.000	2.056	1.185	0.391	0.479	0.330	3.059	3.059	0.000
		Post-Project Segment Directional Safety Index (direction 2)	1.385	1.337	1.183	1.759	1.548	2.007	3.955	4.132	3.189	0.150	0.000	0.150	0.000	2.056	1.185	0.391	0.479	0.330	3.059	3.059	0.000
	SAFETY INDEX	Current Safety Index	3.015	1.189	1.620	1.620	1.620	1.221	2.110	2.110	2.110	1.320	0.279	1.320	0.279	1.634	0.931	0.319	0.319	1.434	6.577	6.577	6.577
		Post-Project Safety Index	1.839	0.883	1.090	1.488	1.459	1.041	2.018	2.105	1.638	1.190	0.261	1.150	0.228	1.094	0.904	0.261	0.319	0.748	5.922	5.922	0.000
	Needs	Original Segment Safety Need	9.238	2.825	4.418	4.418	4.418	2.553	6.452	6.452	6.452	3.09	0.180	3.09	0.180	5.082	0.909	0.206	0.206	4.209	23.902	23.902	23.902
		Post-Project Segment Safety Need	4.751	1.239	2.352	3.911	3.801	1.760	6.102	6.435	4.651	2.526	0.168	2.352	0.147	2.986	0.812	0.168	0.206	0.669	21.402	21.402	0

		Solution #	87.1	87.2	87.3	87.4	87.5	87.6	87.7	87.8	87.9	260.10A-1 (87 Portion)	260.10A-2 (260 Portion)	260.10B-1 (87 Portion)	260.10B-2 (260 Portion)	260.11	260.12	260.13	260.14	260.15	77.16A	77.16B	77.16C
		Description	Gila River Area Safety Improvements	Bush Highway Area Safety and Freight Improvements	Sunflower Area Safety Improvements	Sunflower Area Freight Improvements	Slate Creek Pavement Improvements (Replace)	Rye Area Safety and Freight Improvements	Ox Bow Estates Area Safety Improvements	Ox Bow Estates Area Freight Improvements	Mazatzal Area Safety Improvements	Payson Area Safety and Freight Improvements	Payson Area Safety and Freight Improvements	Payson Area Safety and Freight Improvements	Payson Area Safety and Freight Improvements	Lion Springs Area Mobility and Freight Improvements	Christopher Creek Area Freight Improvements	Mogollon Rim Area Freight Improvements	Mogollon Rim Area Climbing Lane	Forest Lakes Area Safety and Freight Improvements	Holbrook Area Mobility and Freight Improvements (SR 377/SR 77 connection)	Holbrook Area Mobility and Freight Improvements (US 180/SR 77 connection)	Holbrook Area Mobility and Freight Improvements (adjacent to SR 77)
		Project Beg MP	177	191	213	213	224	235	241	243	246	251	252	251	252	256	260	277	277	282	386	386	386
		Project End MP	182	213	235	219	226	241	250	247	251	253	253	253	253	260	277	282	280	304	389	389	389
		Project Length (miles)	3	10	21	6	1	3.8	5	4	4.7	2	1	2	1	4	6.2	5	3	22	2.3	0.8	0.6
		Segment Beg MP	177	191	213	213	213	235	241	241	241	250	252	250	252	256	260	277	277	282	386	386	386
		Segment End MP	182	213	235	235	235	241	250	250	250	253	256	253	256	260	277	282	282	304	389	389	389
		Segment Length (miles)	5	22	22	22	22	6	9	9	9	3	4	3	4	4	17	5	5	22	3.6	1.6	0.6
		Segment #	1	3	4	4	4	5	6	6	6	7	8	7	8	9	10	11	11	12	16	16	16
		Current # of Lanes (both directions)	4	4	4	4	4	4	4	4	4	4	4	4	4	2	4	4	4	2	2	2	2
		Project Type (one-way or two-way)	two-way	two-way	two-way	one-way	two-way	two-way	two-way	one-way	one-way	two-way	two-way	two-way	two-way	two-way	two-way	two-way	one-way	two-way	two-way	two-way	two-way
		Additional Lanes (one-way)	0	0	0	1	0	0	0	1	0	0	0	0	0	2	0	0	1	0.25	2	2	0
		Pro-Rated # of Lanes	4.00	4.00	4.00	4.27	4.00	4.00	4.00	4.44	4.00	4.00	4.00	4.00	4.00	6.00	4.00	4.00	4.60	2.50	4.56	4.00	2.00
		Description																					
MOBILITY	MOBILITY INDEX	Original Segment Mobility Index	0.650	0.210	0.230	0.230	0.230	0.150	0.210	0.210	0.210	0.750	0.540	0.750	0.540	0.940	0.080	0.120	0.120	0.360	0.850	0.850	0.850
		Post-Project # of Lanes (both directions)	4.00	4.00	4.00	4.27	4.00	4.00	4.00	4.44	4.00	4.00	4.00	4.00	4.00	6.00	4.00	4.00	4.60	2.50	4.56	4.00	2.00
		Post-Project Segment Mobility Index	0.65	0.21	0.23	0.22	0.23	0.15	0.19	0.19	0.21	0.75	0.54	0.75	0.54	0.27	0.07	0.11	0.11	0.32	0.68	0.53	0.85
		Post-Project Segment Mobility Index	0.650	0.210	0.230	0.220	0.230	0.150	0.190	0.190	0.210	0.750	0.540	0.750	0.540	0.270	0.070	0.110	0.110	0.320	0.680	0.530	0.770
	FUT V/C	Original Segment Future V/C	0.860	0.290	0.270	0.270	0.270	0.140	0.210	0.210	0.210	0.940	0.680	0.940	0.680	1.150	0.080	0.140	0.140	0.390	1.090	1.090	1.090
		Post-Project Segment Future V/C	0.860	0.290	0.270	0.250	0.270	0.140	0.190	0.190	0.210	0.940	0.680	0.940	0.680	0.330	0.070	0.130	0.120	0.350	0.870	0.700	1.090
		Post-Project Segment Future V/C	0.860	0.290	0.270	0.250	0.270	0.140	0.190	0.190	0.210	0.940	0.680	0.940	0.680	0.330	0.070	0.130	0.120	0.350	0.870	0.700	0.980
	PEAK HOUR V/C	Original Segment Peak Hour V/C (direction 1)	0.340	0.140	0.200	0.200	0.200	0.150	0.190	0.190	0.190	0.570	0.470	0.570	0.470	1.290	0.130	0.140	0.140	0.340	0.600	0.600	0.600
		Original Segment Peak Hour V/C (direction 2)	0.340	0.130	0.210	0.210	0.210	0.150	0.190	0.190	0.190	0.500	0.510	0.500	0.510	1.330	0.110	0.130	0.130	0.340	0.650	0.650	0.650
		Adjusted total # of Lanes for use in directional peak hr	N/A	N/A	N/A	4.55	N/A	N/A	N/A	4.89	4.00	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.20	N/A	N/A	N/A	N/A
		Post-Project Segement Peak Hr V/C (direction 1)	0.340	0.14	0.20	0.18	0.20	0.15	0.17	0.16	0.19	0.51	0.43	0.51	0.43	0.38	0.11	0.12	0.10	0.30	0.48	0.42	0.54
		Post-Project Segement Peak Hr V/C (direction 2)	0.340	0.13	0.21	0.21	0.21	0.15	0.16	0.19	0.19	0.45	0.46	0.45	0.46	0.38	0.10	0.11	0.10	0.30	0.52	0.45	0.59
		Post-Project Segment Peak Hr V/C (direction 1)	0.340	0.140	0.200	0.180	0.200	0.150	0.170	0.160	0.190	0.510	0.430	0.510	0.430	0.380	0.110	0.120	0.100	0.300	0.480	0.420	0.540
		Post-Project Segment Peak Hr V/C (direction 2)	0.340	0.130	0.210	0.210	0.210	0.150	0.160	0.190	0.190	0.450	0.460	0.450	0.460	0.380	0.100	0.110	0.100	0.300	0.520	0.450	0.590
	TTI AND PTI	Safety Reduction Factor	0.610	0.743	0.672	0.918	0.900	0.852	0.956	0.997	0.776	0.902	0.933	0.871	0.815	0.670	0.971	0.817	1.000	0.521	0.900	0.900	0.000
		Safety Reduction	0.390	0.257	0.328	0.082	0.100	0.148	0.044	0.003	0.224	0.098	0.067	0.129	0.185	0.330	0.029	0.183	0.000	0.479	0.100	0.100	1.000
		Mobility Reduction Factor	1.000	1.000	1.000	0.957	1.000	1.000	0.905	0.905	1.000	1.000	1.000	1.000	1.000	0.287	0.875	0.917	0.917	0.889	0.800	0.624	0.906
		Mobility Reduction	0.000	0.000	0.000	0.043	0.000	0.000	0.095	0.095	0.000	0.000	0.000	0.000	0.000	0.713	0.125	0.083	0.083	0.111	0.200	0.376	0.094
		Original Directional Segment TTI (direction 1)	1.218	1.049	1.170	1.170	1.170	1.007	1.306	1.306	1.306	1.180	1.456	1.180	1.456	1.120	1.131	1.233	1.233	1.000	1.075	1.075	1.075
		Original Directional Segment PTI (direction 1)	4.014	1.538	2.051	2.051	2.051	1.422	2.378	2.378	2.378	4.425	7.152	4.425	7.152	1.610	1.638	2.158	2.158	1.178	3.837	3.837	3.837
		Original Directional Segment TTI (direction 2)	1.056	1.042	1.046	1.046	1.046	1.078	1.148	1.148	1.148	1.862	1.097	1.862	1.097	1.000	1.055	1.000	1.000	1.052	1.487	1.487	1.487
		Original Directional Segment PTI (direction 2)	3.033	1.480	1.471	1.471	1.471	1.506	1.937	1.937	1.937	6.477	4.972	6.477	4.972	1.165	1.399	1.141	1.141	1.356	6.793	6.793	6.793
		Reduction Factor for Segment TTI	0.000	0.000	0.000	0.013	0.000	0.000	0.029	0.029	0.000	0.000	0.000	0.000	0.000	0.214	0.038	0.025	0.025	0.033	0.060	0.113	0.028
		Reduction Factor for Segment PTI	0.117	0.077	0.098	0.033	0.030	0.044	0.032	0.020	0.067	0.030	0.020	0.039	0.056	0.242	0.034	0.072	0.017	0.166	0.070	0.105	0.319
		Post-Project Directional Segment TTI (direction 1)	1.218	1.049	1.170	1.155	1.170	1.007	1.269	1.269	1.306	1.180	1.456	~~1.180~~	~~1.456~~	1.060	1.089	1.202	1.202	1.000	~~1.011~~	~~1.038~~	~~1.045~~
		Post-Project Directional Segment PTI (direction 1)	3.544	1.419	1.849	1.983	1.990	1.359	2.302	2.331	2.218	4.294	7.008	~~4.254~~	~~6.754~~	1.221	1.583	2.003	2.122	1.089	~~3.569~~	~~3.433~~	~~2.614~~
		Post-Project Directional Segment TTTI (direction 2)	1.056	1.042	1.046	1.046	1.046	1.078	1.115	1.148	1.148	1.862	1.097	~~1.862~~	~~1.097~~	1.000	1.015	1.000	1.000	1.017	~~1.398~~	~~1.319~~	~~1.445~~
		Post-Project Directional Segment TPTI (direction 2)	2.678	1.366	1.326	1.471	1.427	1.439	1.875	1.937	1.937	6.286	4.872	~~6.227~~	~~4.696~~	1.083	1.35	1.06	1.141	1.131	~~6.318~~	~~6.078~~	~~4.627~~
	CLOSURE EXTENT	Orig Segment Directional Closure Extent (direction 1)	0.372	0.872	1.465	1.465	1.465	0.233	0.178	0.178	0.178	0.070	0.050	0.070	0.050	0.300	0.494	0.400	0.400	0.434	0.000	0.000	0.000
		Orig Segment Directional Closure Extent (direction 2)	0.320	0.109	0.145	0.145	0.145	0.067	0.267	0.267	0.267	0.200	0.000	0.200	0.000	0.550	0.482	0.880	0.880	0.845	0.000	0.000	0.000
		Segment Closures with fatalities/injuries	8	12	17	17	17	3	12	12	12	0	1	0	1	6	5	2	2	9	0	0	0
		Total Segment Closures	12	27	36	36	36	9	18	18	18	2	1	2	1	13	19	11	11	27	0	0	0
		% Closures with Fatality/Injury	0.67	0.44	0.47	0.47	0.47	0.33	0.67	0.67	0.67	0.00	1.00	0.00	1.00	0.46	0.26	0.18	0.18	0.33	0.00	0.00	0.00
		Closure Reduction	0.260	0.114	0.155	0.039	0.047	0.049	0.029	0.002	0.149	0.000	0.067	0.000	0.185	0.152	0.008	0.033	0.000	0.160	0.000	0.000	0.000
		Closure Reduction Factor	0.740	0.886	0.845	0.961	0.953	0.951	0.971	0.998	0.851	1.000	0.933	1.000	0.815	0.848	0.992	0.967	1.000	0.840	0.000	0.000	0.000
		Post-Project Segment Directional Closure Extent (direction 1)	0.275	0.772	1.238	1.408	1.396	0.222	0.173	0.178	0.151	0.070	0.047	~~0.070~~	~~0.041~~	0.254	0.490	0.387	0.400	0.365	0.000	0.000	0.000
		Post-Project Segment Directional Closure Extent (direction 2)	0.237	0.097	0.123	0.145	0.138	0.064	0.259	0.267	0.267	0.200	0.000	~~0.200~~	~~0.000~~	0.466	0.478	0.851	0.880	0.710	0.000	0.000	0.000
	BICYCLE ACCOM	Orig Segment Bicycle Accomodation %	45.0%	99.0%	86.0%	86.0%	86.0%	92.0%	79.0%	79.0%	79.0%	16.0%	16.0%	16.0%	16.0%	2.0%	93.0%	49.0%	49.0%	2.0%	1.0%	1.0%	1.0%
		Orig Segment Outside Shoulder width	6.97	9.42	9.29	9.06	9.29	9.86	7.52	9.96	5.08	4.62	4.62	4.62	4.62	1.21	9.53	5.19	5.19	2.26	0.00	0.00	0.00
		Post-Project Segment Outside Shoulder width	6.97	9.42	9.29	9.06	9.29	9.86	7.52	9.96	8.2	8	5	8	5	10	10	5	5	10	0	0	3
		Post-Project Segment Bicycle Accomodation (%)	45.0%	99.0%	86.0%	86.0%	86.0%	92.0%	79.0%	79.0%	91.0%	56.0%	16.0%	56.0%	16.0%	100.0%	93.0%	49.0%	49.0%	100.0%	1.0%	1.0%	20.0%
		Post-Project Segment Bicycle Accomodation (%)	45.0%	99.0%	86.0%	86.0%	86.0%	92.0%	79.0%	79.0%	91.0%	56.0%	16.0%	56.0%	16.0%	100.0%	93.0%	49.0%	49.0%	100.0%	1.0%	1.0%	20.0%
	Needs	Original Segment Mobility Need	1.609	1.048	1.750	1.750	1.750	0.674	2.035	2.035	2.035	2.046	1.635	2.046	1.635	6.880	0.877	1.891	1.891	1.669	3.549	3.549	3.549
		Post-Project Segment Mobility Need	1.561	0.774	1.380	1.664	1.551	0.539	1.875	1.947	1.829	2.016	1.611	1.884	1.491	0.669	0.814	1.700	1.809	0.815	1.566	1.513	1.838

Original Values for Segment 16(Solution CS 77.1	Reduction for A 10% PTI 10% TTI 0.9	Reduction for B 10% PTI 10% TTI 0.9	Reduction for C 80% PTI 80% TTI 0.2
1.075	0.9675	0.9675	0.215
3.837	3.4533	3.4533	0.7674
1.487	1.3383	1.3383	0.2974
6.793	6.1137	6.1137	1.3586

Reduction in TTI and PTI for Roundabouts (10%)

260.10A-1 (87 Portion)	260.10A-2 (260 Portion)	260.10B-1 (87 Portion)	(260 Portion)
-	-	1.062	1.310
-	-	3.829	6.079
-	-	1.676	0.987
-	-	5.604	4.226

Reduced value for closures for Roundabouts (10% reduction)

-	-	0.063	0.037
-	-	0.180	0.000

		Solution #	87.1	87.2	87.3	87.4	87.5	87.6	87.7	87.8	87.9	260.10A-1 (87 Portion)	260.10A-2 (260 Portion)	260.10B-1 (87 Portion)	260.10B-2 (260 Portion)	260.11	260.12	260.13	260.14	260.15	77.16A	77.16B	77.16C				
		Description	Gila River Area Safety Improvements	Bush Highway Area Safety and Freight Improvements	Sunflower Area Safety Improvements	Sunflower Area Freight Improvements	Slate Creek Pavement Improvements (Replace)	Rye Area Safety and Freight Improvements	Ox Bow Estates Area Safety Improvements	Ox Bow Estates Area Freight Improvements	Mazatzal Area Safety Improvements	Payson Area Safety and Freight Improvements	Payson Area Safety and Freight Improvements	Payson Area Safety and Freight Improvements	Payson Area Safety and Freight Improvements	Lion Springs Area Mobility and Freight Improvements	Christopher Creek Area Freight Improvements	Mogollon Rim Area Freight Improvements	Mogollon Rim Area Climbing Lane	Forest Lakes Area Safety and Freight Improvements	Holbrook Area Mobility and Freight Improvements (SR 377/SR 77 connection)	Holbrook Area Mobility and Freight Improvements (US 180/SR 77 connection)	Holbrook Area Mobility and Freight Improvements (adjacent to SR 77)				
		Project Beg MP	177	191	213	213	224	235	241	243	246	251	252	251	252	256	260	277	277	282	386	386	386				
		Project End MP	182	213	235	219	226	241	250	247	251	253	253	253	253	260	277	282	280	304	389	389	389				
		Project Length (miles)	3	10	21	6	1	3.8	5	4	4.7	2	1	2	1	4	6.2	5	3	22	2.3	0.8	0.6				
		Segment Beg MP	177	191	213	213	213	235	241	241	241	250	252	250	252	256	260	277	277	282	386	386	386				
		Segment End MP	182	213	235	235	235	241	250	250	250	253	256	253	256	260	277	282	282	304	389	389	389				
		Segment Length (miles)	5	22	22	22	22	6	9	9	9	3	4	3	4	4	17	5	5	22	3.6	1.6	0.6				
		Segment #	1	3	4	4	4	5	6	6	6	7	8	7	8	9	10	11	11	12	16	16	16				
		Current # of Lanes (both directions)	4	4	4	4	4	4	4	4	4	4	4	4	4	2	4	4	4	2	2	2	2				
		Project Type (one-way or two-way)	two-way	two-way	two-way	one-way	two-way	two-way	two-way	one-way	one-way	two-way	two-way	two-way	two-way	two-way	two-way	two-way	one-way	two-way	two-way	two-way	two-way				
		Additional Lanes (one-way)	0	0	0	1	0	0	0	1	0	0	0	0	0	2	0	0	1	0.25	2	2	0				
		Pro-Rated # of Lanes	4.00	4.00	4.00	4.27	4.00	4.00	4.00	4.44	4.00	4.00	4.00	4.00	4.00	6.00	4.00	4.00	4.60	2.50	4.56	4.00	2.00				
		Description																									
FREIGHT	TTTI AND TPTI	Original Directional Segment TTTI (direction 1)	1.288	1.112	1.374	1.374	1.374	1.115	1.551	1.551	1.551	1.199	1.663	1.199	1.663	1.202	1.227	1.446	1.446	1.003	1.117	1.117	1.117				
		Original Directional Segment TPTI (direction 1)	3.877	1.377	2.378	2.378	2.378	1.453	2.520	2.520	2.520	3.294	9.645	3.294	9.645	3.087	1.821	2.528	2.528	1.194	3.525	3.525	3.525	Original Values for Segment 16(Solution CS 77.16)	Reduction for A 80% PTI 80% TTI 0.2	Reduction for B 80% PTI 80% TTI 0.2	Reduction for C 100% PTI 100% TTI 0
		Original Directional Segment TTTI (direction 2)	1.105	1.235	1.141	1.141	1.141	1.211	1.220	1.220	1.220	1.911	1.168	1.911	1.168	1.000	1.117	1.000	1.000	1.101	1.537	1.537	1.537				
		Original Directional Segment TPTI (direction 2)	3.385	2.377	1.562	1.562	1.562	2.134	2.012	2.012	2.012	3.878	4.106	3.878	4.106	1.212	1.612	1.180	1.180	1.691	5.648	5.648	5.648				
		Reduction Factor for Segment TTTI (both directions)	0.000	0.000	0.000	0.007	0.000	0.000	0.014	0.014	0.000	0.000	0.000	0.000	0.000	0.107	0.019	0.013	0.013	0.017	0.030	0.056	0.014				
		Reduction Factor for Segment TPTI (both directions)	0.059	0.039	0.049	0.017	0.015	0.022	0.016	0.010	0.034	0.015	0.010	0.019	0.028	0.121	0.017	0.036	0.008	0.083	0.035	0.053	0.159				
		Post-Project Directional Segment TTTI (direction 1)	1.288	1.112	1.374	1.365	1.374	1.115	1.529	1.529	1.551	1.199	1.663	~~1.199~~	~~1.663~~	1.073	1.204	1.428	1.428	0.995	~~1.083~~	~~1.054~~	~~1.101~~	1.117	0.2234	0.2234	0
		Post-Project Directional Segment TPTI (direction 1)	3.650	1.324	2.261	2.338	2.342	1.421	2.479	2.495	2.435	3.245	9.548	~~3.230~~	~~9.377~~	2.714	1.790	2.437	2.507	1.095	~~3.402~~	~~3.340~~	~~2.963~~	3.525	0.705	0.705	0
		Post-Project Directional Segment TTTI (direction 2)	1.105	1.235	1.141	1.141	1.141	1.211	1.203	1.220	1.220	1.911	1.168	~~1.911~~	~~1.168~~	1.000	1.096	1.000	1.000	1.083	~~1.491~~	~~1.450~~	~~1.515~~	1.537	0.3074	0.3074	0
		Post-Project Directional Segment TPTI (direction 2)	3.187	2.285	1.485	1.562	1.539	2.087	1.980	2.012	2.012	3.821	4.065	~~3.803~~	~~3.992~~	1.066	1.585	1.138	1.180	1.551	~~5.451~~	~~5.351~~	~~4.748~~	5.648	1.1296	1.1296	0
	FREIGHT INDEX	Original Segment TPTI (direction 1)	3.877	1.377	2.378	2.378	2.378	1.453	2.520	2.520	2.520	3.294	9.645	3.294	9.645	3.087	1.821	2.528	2.528	1.194	3.525	3.525	3.525	Reduction in TTI and PTI for Roundabouts (10%)			
		Original Segment TPTI (direction 2)	3.385	2.377	1.562	1.562	1.562	2.134	2.012	2.012	2.012	3.878	4.106	3.878	4.106	1.212	1.612	1.180	1.180	1.691	5.648	5.648	5.648	(87 Portion)	(260 Portion)	(87 Portion)	(260
		Original Segment Freight Index	0.275	0.533	0.508	0.508	0.508	0.558	0.441	0.441	0.441	0.279	0.145	0.279	0.145	0.465	0.583	0.539	0.539	0.693	0.218	0.218	0.218	-	-	1.079	1.497
		Post-Project Segment TPTI (direction 1)	3.650	1.324	2.261	2.338	2.342	1.421	2.479	2.495	2.435	3.245	9.548	3.230	9.377	2.714	1.790	2.437	2.507	1.095	3.402	3.340	2.963	-	-	2.907	8.439
		Post-Project Segment TPTI (direction 2)	3.187	2.285	1.485	1.562	1.539	2.087	1.980	2.012	2.012	3.821	4.065	3.803	3.992	1.066	1.585	1.138	1.180	1.551	5.451	5.351	4.748	-	-	1.720	1.051
		Post-Project Segment Freight Index	0.293	0.554	0.534	0.513	0.515	0.570	0.449	0.444	0.450	0.283	0.147	0.316	0.166	0.529	0.593	0.559	0.542	0.756	1.090	1.090	1.000	-	-	3.423	3.593
	CLOSURE DURATION	Orig Segment Directional Closure Duration (dir 1)	129.188	2674.129	4359.887	4359.887	4359.887	49.200	37.156	37.156	37.156	21.333	11.450	21.333	11.450	71.850	157.494	144.400	144.400	117.012	0.000	0.000	0.000				
		Orig Segment Directional Closure Duration (dir 2)	61.920	59.227	34.009	34.009	34.009	21.667	287.978	287.978	287.978	693.600	0.000	693.600	0.000	726.900	797.706	922.040	922.040	901.618	0.000	0.000	0.000				
		Segment Closures with fatalities	8	12	17	17	17	3	12	12	12	0	1	0	1	6	5	2	2	9	0	0	0				
		Total Segment Closures	12	27	36	36	36	9	18	18	18	2	1	2	1	13	19	11	11	27	0	0	0				
		% Closures with Fatality	0.67	0.44	0.47	0.47	0.47	0.33	0.67	0.67	0.67	0.00	1.00	0.00	1.00	0.46	0.26	0.18	0.18	0.33	0.00	0.00	0.00				
		Closure Reduction	0.260	0.114	0.155	0.039	0.047	0.049	0.029	0.002	0.149	0.000	0.067	0.000	0.185	0.152	0.008	0.033	0.000	0.160	0.000	0.000	0.000				
		Closure Reduction Factor	0.740	0.886	0.845	0.961	0.953	0.951	0.971	0.998	0.851	1.000	0.933	1.000	0.815	0.848	0.992	0.967	1.000	0.840	0.000	0.000	0.000	Reduced value for closures for Roundabouts (10% reduction)			
		Post-Project Segment Directional Closure Duration (direction 1)	95.589	2368.478	3685.277	4190.942	4154.732	46.778	36.074	37.088	31.617	21.333	10.681	~~21.333~~	~~9.328~~	60.898	156.291	139.585	144.400	98.338	0.000	0.000	0.000	-	-	19.20	8.40
		Post-Project Segment Directional Closure Duration (direction 2)	45.816	52.457	28.747	34.009	32.409	20.600	279.589	287.978	287.978	693.600	0.000	~~693.600~~	~~0.000~~	616.096	791.613	891.297	922.040	757.729	0.000	0.000	0.000	-	-	624.24	0.00
	VERT CLR	Original Segment Vertical Clearance	No Change	16.97	18.75	18.75	18.75	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change				
		Original vertical clearance for specific bridge	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change				
		Post-Project vertical clearance for specific bridge	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change				
		Post-Project Segment Vertical Clearance	No Change	16.97	18.75	18.75	18.75	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change				
		Post-Project Segment Vertical Clearance	No Change	16.97	18.75	18.75	18.75	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change	No Change				
	Needs	Original Segment Freight Need	0.944	8.709	12.193	12.193	12.193	3.617	5.340	5.340	5.340	2.072	2.825	2.072	2.825	5.671	5.151	5.928	5.928	3.957	1.864	1.864	1.864				
		Post-Project Segment Freight Need	0.76	8.017	10.748	11.833	11.755	3.527	5.221	5.298	5.258	2.051	2.801	1.702	2.493	5.065	5.048	5.746	5.893	2.246	0.092	0.092	0.090				

		Solution #	87.1	87.2	87.3	87.4	87.5	87.6	87.7	87.8	87.9	260.10A-1 (87 Portion)	260.10A-2 (260 Portion)	260.10B-1 (87 Portion)	260.10B-2 (260 Portion)	260.11	260.12	260.13	260.14	260.15	77.16A	77.16B	77.16C
		Description	Gila River Area Safety Improvements	Bush Highway Area Safety and Freight Improvements	Sunflower Area Safety Improvements	Sunflower Area Freight Improvements	Slate Creek Pavement Improvements (Replace)	Rye Area Safety and Freight Improvements	Ox Bow Estates Area Safety Improvements	Ox Bow Estates Area Freight Improvements	Mazatzal Area Safety Improvements	Payson Area Safety and Freight Improvements	Payson Area Safety and Freight Improvements	Payson Area Safety and Freight Improvements	Payson Area Safety and Freight Improvements	Lion Springs Area Mobility and Freight Improvements	Christopher Creek Area Freight Improvements	Mogollon Rim Area Freight Improvements	Mogollon Rim Area Climbing Lane	Forest Lakes Area Safety and Freight Improvements	Holbrook Area Mobility and Freight Improvements (SR 377/SR 77 connection)	Holbrook Area Mobility and Freight Improvements (US 180/SR 77 connection)	Holbrook Area Mobility and Freight Improvements (adjacent to SR 77)
		Project Beg MP	177	191	213	213	224	235	241	243	246	251	252	251	252	256	260	277	277	282	386	386	386
		Project End MP	182	213	235	219	226	241	250	247	251	253	253	253	253	260	277	282	280	304	389	389	389
		Project Length (miles)	3	10	21	6	1	3.8	5	4	4.7	2	1	2	1	4	6.2	5	3	22	2.3	0.8	0.6
		Segment Beg MP	177	191	213	213	213	235	241	241	241	250	252	250	252	256	260	277	277	282	386	386	386
		Segment End MP	182	213	235	235	235	241	250	250	250	253	256	253	256	260	277	282	282	304	389	389	389
		Segment Length (miles)	5	22	22	22	22	6	9	9	9	3	4	3	4	4	17	5	5	22	3.6	1.6	0.6
		Segment #	1	3	4	4	4	5	6	6	6	7	8	7	8	9	10	11	11	12	16	16	16
		Current # of Lanes (both directions)	4	4	4	4	4	4	4	4	4	4	4	4	4	2	4	4	4	2	2	2	2
		Project Type (one-way or two-way)	two-way	two-way	two-way	one-way	two-way	two-way	two-way	one-way	one-way	two-way	two-way	two-way	two-way	two-way	two-way	two-way	one-way	two-way	two-way	two-way	two-way
		Additional Lanes (one-way)	0	0	0	1	0	0	0	1	0	0	0	0	0	2	0	0	1	0.25	2	2	0
		Pro-Rated # of Lanes	4.00	4.00	4.00	4.27	4.00	4.00	4.00	4.44	4.00	4.00	4.00	4.00	4.00	6.00	4.00	4.00	4.60	2.50	4.56	4.00	2.00
		Description																					
BRIDGE	BRIDGE INDEX	Original Segment Bridge Index																			6.00	6.00	6.00
		Original lowest rating for specific bridge																			6	6	6
		Post-Project lowest rating for specific bridge																			8	8	8
		Post-Project lowest rating for specific bridge	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	8	8
		Post-Project Segment Bridge Index																			8.00	8.00	8.00
		Post-Project Segment Bridge Index	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	8.00	8.00
	SUFF RATING	Original Segment Sufficiency Rating																			59.00	59.00	59.00
		Original Sufficiency Rating for specific bridge																			59.00	59.00	59.00
		Post-Project Sufficiency Rating for specific bridge																			98.00	98.00	98.00
		Post-Project Sufficiency Rating for specific bridge	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	98.00	98.00	98.00
		Post-Project Segment Sufficiency Rating																			98.00	98.00	98.00
		Post-Project Segment Sufficiency Rating	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	98.00	98.00	98.00
	BR RTNG	Original Segment Bridge Rating																			6	6	6
		Post-Project Segment Bridge Rating																			8	8	8
		Post-Project Segment Bridge Rating	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	8	8
	% FUN OB	Original Segment % Functionally Obsolete																			100.00%	100.00%	100.00%
		Post-Project Segment % Functionally Obsolete																			0.00%	0.00%	0.00%
		Post-Project Segment % Functionally Obsolete	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Needs	Original Segment Bridge Need																			1.343	1.343	1.343
		Post-Project Segment Bridge Need																			0.000	0.000	0.000
PAVEMENT	PAVEMENT INDEX	Original Segment Pavement Index					4.05																3.25
		Original Segment IRI in project limits					91																159.733
		Original Segment Cracking in project limits					3.9																0
		Post-Project IRI in project limits					45																30
		Post-Project IRI in project limits	0	0	0	0	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
		Post-Project Cracking in project limits					0																0
		Post-Project Cracking in project limits	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Post-Project Segment Pavement Index					4.24																4.01
		Post-Project Segment Pavement Index	0	0	0	0	4.24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4.01
	DIRECTION PSR	Original Segment Directional PSR (direction 1)					3.84																3.1
		Original Segment Directional PSR (direction 2)					3.93																-
		Original Segment IRI in project limits	0	0	0	0	91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	159.733
		Post-Project directional IRI in project limits	0	0	0	0	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
		Post-Project Segment Directional PSR (direction 1)					4.02																3.79
		Post-Project Segment Directional PSR (direction 2)					4.08																-
		Post-Project Segment Directional PSR (direction 1)	0	0	0	0	4.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.79
		Post-Project Segment Directional PSR (direction 2)	0	0	0	0	4.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	% FAIL	Original Segment % Failure					0.0%																40.0%
		Post-Project Segment % Failure					0.0%																0.0%
		Post-Project Segment % Failure	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Needs	Original Segment Pavement Need					0.000																1.850
		Post-Project Segment Pavement Need					0.000																0.000

Performance Area Scoring

Candidate Solution #	Candidate Solution Name	Milepost Location	Estimated Cost ($ millions)	Pavement					Bridge					Safety					Mobility					Freight					Total Risk Factored Performance Area Benefit
				Existing Segment Need	Post-Solution Segment Need	Raw Score	Risk Factor	Factored Score	Existing Segment Need	Post-Solution Segment Need	Raw Score	Risk Factor	Factored Score	Existing Segment Need	Post-Solution Segment Need	Raw Score	Risk Factor	Factored Score	Existing Segment Need	Post-Solution Segment Need	Raw Score	Risk Factor	Factored Score	Existing Segment Need	Post-Solution Segment Need	Raw Score	Risk Factor	Factored Score	
CS87.1	Salt River Area Safety Improvements	177-182	4.24			0.000		0.000			0.000		0.000	9.238	4.751	4.487	4.10	18.381	1.609	1.561	0.048	1.63	0.078	0.944	0.760	0.184	1.34	0.246	18.706
CS87.2	Bush Highway Area Safety and Freight Improvements	191-213	6.8			0.000		0.000			0.000		0.000	2.825	1.239	1.586	1.40	2.226	1.048	0.774	0.274	6.68	1.830	8.709	8.017	0.692	5.55	3.839	7.895
CS87.3	Sunflower Area Safety Improvements	213-235	18.33			0.000		0.000			0.000		0.000	4.418	2.352	2.066	2.77	5.713	1.750	1.380	0.370	7.39	2.735	12.193	10.748	1.445	5.59	8.078	16.526
CS87.4	Sunflower Area Freight Improvements	213-219	42.04			0.000		0.000			0.000		0.000	4.418	3.911	0.507	2.97	1.503	1.750	1.664	0.086	6.48	0.557	12.193	11.833	0.360	5.59	2.013	4.073
CS87.5B	Slate Creek Pavement Improvements (Replace)	224-226	7.19	0.000	0.000	0.000	1.92	0.000			0.000		0.000	4.418	3.801	0.617	2.97	1.829	1.750	1.551	0.199	6.48	1.290	12.193	11.755	0.438	5.59	2.449	5.568
CS87.6	Rye Area Safety and Freight Improvements	235-241	0.22			0.000		0.000			0.000		0.000	2.553	1.760	0.793	0.78	0.622	0.674	0.539	0.135	5.37	0.725	3.617	3.527	0.090	5.65	0.509	1.856
CS87.7	Ox Bow Estates Area Safety Improvements	241-250	2.4			0.000		0.000			0.000		0.000	6.452	6.102	0.350	3.36	1.176	2.035	1.875	0.160	6.39	1.023	5.340	5.221	0.119	5.65	0.672	2.871
CS87.8	Ox Bow Estates Area Freight Improvements	243-247	25.41			0.000		0.000			0.000		0.000	6.452	6.435	0.017	3.78	0.064	2.035	1.947	0.088	6.20	0.545	5.340	5.298	0.042	5.65	0.237	0.847
CS87.9	Mazatzal Area Safety Improvements	246-251	2.28			0.000		0.000			0.000		0.000	6.452	4.651	1.801	3.02	5.439	2.035	1.829	0.206	6.34	1.305	5.340	5.258	0.082	5.65	0.463	7.208
CS260.10A	Payson Area Safety and Freight Improvements	251-253	0.40											3.270	2.694	0.576	5.10	2.935	3.681	3.627	0.054	2.23	0.121	4.897	4.852	0.045	1.97	0.089	3.144
CS260.10A-1 (87 Portion)	Payson Area Safety and Freight Improvements	251-253	0.40			0.000		0.000			0.000		0.000	3.090	2.526	0.564	5.09	2.872	2.046	2.016	0.030	2.39	0.072	2.072	2.051	0.021	1.61	0.034	2.978
CS260.10A-2 (260 Portion)	Payson Area Safety and Freight Improvements	252-253	0.40			0.000		0.000			0.000		0.000	0.180	0.168	0.012	5.23	0.063	1.635	1.611	0.024	2.03	0.049	2.825	2.801	0.024	2.28	0.055	0.166
CS260.10B	Payson Area Safety and Freight Improvements	251-253	13.78											3.270	2.499	0.771	5.10	3.931	3.681	3.375	0.306	2.22	0.680	4.897	4.195	0.702	1.93	1.353	5.965
CS260.10B-1 (87 Portion)	Payson Area Safety and Freight Improvements	251-253	13.78			0.000		0.000			0.000		0.000	3.090	2.352	0.738	5.09	3.759	2.046	1.884	0.162	2.39	0.388	2.072	1.702	0.370	1.61	0.597	4.743
CS260.10B-2 (260 Portion)	Payson Area Safety and Freight Improvements	252-253	13.78			0.000		0.000			0.000		0.000	0.180	0.147	0.033	5.23	0.173	1.635	1.491	0.144	2.03	0.293	2.825	2.493	0.332	2.28	0.756	1.221
CS260.11	Lion Springs Area Mobility and Freight Improvements	256-260	50.00			0.000		0.000			0.000		0.000	5.082	2.986	2.096	3.55	7.433	6.880	0.669	6.211	7.98	49.536	5.671	5.065	0.606	7.65	4.634	61.603
CS260.12	Christopher Creek Area Freight Improvements	260-277	6.13			0.000		0.000			0.000		0.000	0.909	0.812	0.097	3.38	0.328	0.877	0.814	0.063	5.67	0.357	5.151	5.048	0.103	5.15	0.530	1.215
CS260.13	Mogollon Rim Area Freight Improvements	277-282	8.47			0.000		0.000			0.000		0.000	0.206	0.168	0.038	5.46	0.208	1.891	1.700	0.191	5.86	1.120	5.928	5.746	0.182	5.23	0.953	2.280
CS260.14	Mogollon Rim Area Climbing Lane	277-280	19.07			0.000		0.000			0.000		0.000	0.206	0.206	0.000	5.46	0.000	1.891	1.809	0.082	5.56	0.456	5.928	5.893	0.035	5.23	0.183	0.639
CS260.15	Forest Lakes Area Safety and Freight Improvements	282-304	56.48			0.000		0.000			0.000		0.000	4.209	0.669	3.540	3.73	13.208	1.669	0.815	0.854	8.30	7.087	3.957	2.246	1.711	7.27	12.435	32.729
CS77.16A	Holbrook Area Mobility and Freight Improvements (SR 377/SR 77 connection)	386-389	92.07			0.000		0.000			0.000		0.000	23.902	21.402	2.500	4.95	12.386	3.549	1.566	1.983	7.10	14.075	1.864	0.092	1.772	6.82	12.086	38.546
CS77.16B	Holbrook Area Mobility and Freight Improvements (US 180/SR 77 connection)	386-389	75.76			0.000		0.000			0.000		0.000	23.902	21.402	2.500	4.95	12.386	3.549	1.513	2.036	6.76	13.759	1.864	0.092	1.772	6.82	12.086	38.230
CS77.16C	Holbrook Area Mobility and Freight Improvements (adjacent to SR 77)	386-389	46.42	1.850	0.000	1.850	2.34	4.337	1.343	0.000	1.343	4.13	5.545	23.902	0.000	23.902	4.95	118.416	3.549	1.838	1.711	6.71	11.478	1.864	0.090	1.774	6.82	12.099	151.875

Emphasis Area Scoring

Candidate Solution #	Candidate Solution Name	Milepost Location	Estimated Cost ($ millions)	Safety Emphasis Area						Mobility Emphasis Area						Freight Emphasis Area					
				Existing Corridor Need	Post-Solution Corridor Need	Raw Score	Risk Factor	Emphasis Factor	Factored Score	Existing Corridor Need	Post-Solution Corridor Need	Raw Score	Risk Factor	Emphasis Factor	Factored Score	Existing Corridor Need	Post-Solution Corridor Need	Raw Score	Risk Factor	Emphasis Factor	Factored Score
CS87.1	Salt River Area Safety Improvements	177-182	4.24	3.072	2.939	0.133	4.10	1.50	0.815	0.255	0.255	0.000	1.63	1.50	0.000	2.669	2.668	0.001	1.34	1.50	0.002
CS87.2	Bush Highway Area Safety and Freight Improvements	191-213	6.8	3.072	2.930	0.141	1.40	1.50	0.297	0.255	0.255	0.000	6.68	1.50	0.000	2.669	2.663	0.006	5.55	1.50	0.049
CS87.3	Sunflower Area Safety Improvements	213-235	18.33	3.072	2.822	0.250	2.77	1.50	1.035	0.255	0.255	0.000	7.39	1.50	0.000	2.669	2.662	0.007	5.59	1.50	0.060
CS87.4	Sunflower Area Freight Improvements	213-219	42.04	3.072	3.009	0.062	2.97	1.50	0.277	0.255	0.254	0.001	6.48	1.50	0.012	2.669	2.667	0.001	5.59	1.50	0.013
CS87.5B	Slate Creek Pavement Improvements (Replace)	224-226	7.19	3.072	2.996	0.076	2.97	1.50	0.338	0.255	0.255	0.000	6.48	1.50	0.000	2.669	2.667	0.002	5.59	1.50	0.017
CS87.6	Rye Area Safety and Freight Improvements	235-241	0.22	3.072	3.051	0.021	0.78	1.50	0.024	0.255	0.255	0.000	5.37	1.50	0.000	2.669	2.668	0.001	5.65	1.50	0.008
CS87.7	Ox Bow Estates Area Safety Improvements	241-250	2.4	3.072	3.049	0.023	3.36	1.50	0.114	0.255	0.254	0.001	6.39	1.50	0.010	2.669	2.668	0.001	5.65	1.50	0.008
CS87.8	Ox Bow Estates Area Freight Improvements	243-247	25.41	3.072	3.070	0.001	3.78	1.50	0.007	0.255	0.254	0.001	6.20	1.50	0.010	2.669	2.669	0.000	5.65	1.50	0.003
CS87.9	Mazatzal Area Safety Improvements	246-251	2.28	3.072	2.956	0.116	3.02	1.50	0.524	0.255	0.255	0.000	6.34	1.50	0.000	2.669	2.668	0.001	5.65	1.50	0.009
CS260.10A	Payson Area Safety and Freight Improvements	251-253	0.4	-	-	-	-	1.50	0.294	-	-	-	-	1.50	0.000	-	-	-	-	1.50	0.000
CS260.10A-1 (87 Portion)	Payson Area Safety and Freight Improvements	251-253	0.40	3.003	2.999	0.004	5.09	1.50	0.031	0.255	0.255	0.000	2.39	1.50	0.000	2.669	2.669	0.000	1.61	1.50	0.000
CS260.10A-2 (260 Portion)	Payson Area Safety and Freight Improvements	252-253	0.40	3.072	3.038	0.034	5.23	1.50	0.263	0.255	0.255	0.000	2.03	1.50	0.000	2.669	2.669	0.000	2.28	1.50	0.000
CS260.10B	Payson Area Safety and Freight Improvements	251-253	13.78	-	-	-	-	1.50	0.780	-	-	-	-	1.50	0.000	-	-	-	-	1.50	0.006
CS260.10B-1 (87 Portion)	Payson Area Safety and Freight Improvements	251-253	13.78	3.003	2.998	0.005	5.09	1.50	0.038	0.255	0.255	0.000	2.39	1.50	0.000	2.669	2.668	0.001	1.61	1.50	0.002
CS260.10B-2 (260 Portion)	Payson Area Safety and Freight Improvements	252-253	13.78	3.072	2.977	0.095	5.23	1.50	0.742	0.255	0.255	0.000	2.03	1.50	0.000	2.669	2.668	0.001	2.28	1.50	0.004
CS260.11	Lion Springs Area Mobility and Freight Improvements	256-260	50.00	3.003	2.968	0.035	3.55	1.50	0.186	0.255	0.242	0.013	7.98	1.50	0.158	2.669	2.666	0.003	7.65	1.50	0.032
CS260.12	Christopher Creek Area Freight Improvements	260-277	6.46	3.072	3.062	0.009	3.38	1.50	0.047	0.255	0.254	0.001	5.67	1.50	0.008	2.669	2.667	0.002	5.15	1.50	0.017
CS260.13	Mogollon Rim Area Freight Improvements	277-282	8.47	3.003	2.998	0.005	5.46	1.50	0.041	0.255	0.255	0.000	5.86	1.50	0.002	2.669	2.668	0.001	5.23	1.50	0.010
CS260.14	Mogollon Rim Area Climbing Lane	277-280	19.07	3.003	3.003	0.000	5.46	1.50	0.000	0.255	0.255	0.000	5.56	1.50	0.002	2.669	2.669	0.000	5.23	1.50	0.001
CS260.15	Forest Lakes Area Safety and Freight Improvements	282-304	56.48	3.072	2.753	0.319	3.73	1.50	1.783	0.255	0.250	0.005	8.30	1.50	0.061	2.669	2.652	0.017	7.27	1.50	0.190
CS77.16A	Holbrook Area Mobility and Freight Improvements (SR 377/SR 77 connection)	386-389	92.07	3.003	2.974	0.029	4.95	1.50	0.216	0.255	0.252	0.003	7.10	1.50	0.036	2.669	2.645	0.024	6.82	1.50	0.245
CS77.16B	Holbrook Area Mobility and Freight Improvements (US 180/SR 77 connection)	386-389	75.76	3.003	2.974	0.029	4.95	1.50	0.216	0.255	0.251	0.005	6.76	1.50	0.046	2.669	2.645	0.024	6.82	1.50	0.245
CS77.16C	Holbrook Area Mobility and Freight Improvements (adjacent to SR 77)	386-389	46.42	3.003	2.714	0.289	4.95	1.50	2.148	0.255	0.254	0.001	6.71	1.50	0.011	2.669	2.645	0.024	6.82	1.50	0.245

Performance Effectiveness Scoring

Candidate Solution #	Candidate Solution Name	Milepost Location	Estimated Cost ($ millions)	Total Factored Benefit	VMT Factor	NPV Factor	Performance Effectiveness Score	miles	2014 ADT	1-way or 2-way	VMT
CS87.1	Salt River Area Safety Improvements	177-182	4.24	19.523	1.43	15.3	100.6	1.60	15116	2	24185.222
CS87.2	Bush Highway Area Safety and Freight Improvements	191-213	6.8	8.241	3.72	15.3	69.1	10.00	9827	2	98270
CS87.3	Sunflower Area Safety Improvements	213-235	18.33	17.621	4.78	15.3	70.4	21.00	10778	2	226338
CS87.4	Sunflower Area Freight Improvements	213-219	42.04	4.375	1.81	20.2	3.8	6.00	10778	1	32334
CS87.5B	Slate Creek Pavement Improvements (Replace)	224-226	7.19	5.923	0.70	15.3	8.8	1.00	10778	2	10778
CS87.6	Rye Area Safety and Freight Improvements	235-241	0.22	1.888	1.53	8.8	115.8	2.25	11717	2	26363.25
CS87.7	Ox Bow Estates Area Safety Improvements	241-250	2.4	3.003	2.79	15.3	53.3	5.00	11717	2	58585
CS87.8	Ox Bow Estates Area Freight Improvements	243-247	25.41	0.867	1.39	20.2	1.0	4.00	11717	1	23434
CS87.9	Mazatzal Area Safety Improvements	246-251	2.28	7.740	1.59	15.3	82.6	4.70	11717	1	27534.95
CS260.10A	Payson Area Safety and Freight Improvements	251-253	0.4	3.439	1.98	8.8	150.2	-	-	-	36389.2
CS260.10A-1 (87 Portion)	Payson Area Safety and Freight Improvements	251-253	0.40	3.009	1.74	8.8	114.0	1.60	19185	2	30696
CS260.10A-2 (260 Portion)	Payson Area Safety and Freight Improvements	252-253	0.40	0.430	0.38	8.8	3.6	0.40	14233	2	5693.2
CS260.10B	Payson Area Safety and Freight Improvements	251-253	13.78	6.750	1.98	20.2	19.6	-	-	-	36389.2
CS260.10B-1 (87 Portion)	Payson Area Safety and Freight Improvements	251-253	13.78	4.783	1.74	20.2	12.2	1.60	19185	2	30696
CS260.10B-2 (260 Portion)	Payson Area Safety and Freight Improvements	252-253	13.78	1.967	0.38	20.2	1.1	0.40	14233	2	5693.2
CS260.11	Lion Springs Area Mobility and Freight Improvements	256-260	50.00	61.980	2.68	20.2	67.1	4.00	13796	2	55184
CS260.12	Christopher Creek Area Freight Improvements	260-277	6.46	1.288	2.09	15.3	6.4	6.20	6270	2	38871.66
CS260.13	Mogollon Rim Area Freight Improvements	277-282	8.47	2.333	1.73	15.3	7.3	5.00	6112	2	30558.473
CS260.14	Mogollon Rim Area Climbing Lane	277-280	19.07	0.643	0.60	20.2	0.4	3.00	6112	1	9167.5418
CS260.15	Forest Lakes Area Safety and Freight Improvements	282-304	56.48	34.764	4.19	20.2	52.1	22.00	5954	2	130988
CS77.16A	Holbrook Area Mobility and Freight Improvements (SR 377/SR 77 connection)	386-389	92.07	39.042	1.09	30.6	14.1	2.30	7694	2	17696.2
CS77.16B	Holbrook Area Mobility and Freight Improvements (US 180/SR 77 connection)	386-389	75.76	38.736	0.41	30.6	6.4	0.80	7694	2	6155.2
CS77.16C	Holbrook Area Mobility and Freight Improvements (adjacent to SR 77)	386-389	46.42	154.278	0.31	30.6	31.6	0.60	7694	2	4616.4

APPENDIX F: SOLUTION PRIORITIZATION SCORES

Candidate Solution #	Candidate Solution Name	Milepost Location	Estimated Cost ($ millions)	Pavement		Bridge		Safety		Mobility		Freight		Total Factored Score	Risk Factors					Weighted Risk Factor	Segment Need	Prioritization Score
				Score	%	Score	%	Score	%	Score	%	Score	%		Pavement	Bridge	Safety	Mobility	Freight			
CS87.1	Salt River Area Safety Improvements	177-182	4.24	0.000	0.0%	0.000	0.0%	19.196	98.3%	0.078	0.4%	0.248	1.3%	19.523	1.14	1.51	1.78	1.36	1.36	1.773	1.308	**233**
CS87.2	Bush Highway Area Safety and Freight Improvements	191-213	6.8	0.000	0.0%	0.000	0.0%	2.524	30.6%	1.830	22.2%	3.887	47.2%	8.241	1.14	1.51	1.78	1.36	1.36	1.489	1.769	**182**
CS87.3	Sunflower Area Safety Improvements	213-235	18.33	0.000	0.0%	0.000	0.0%	6.748	38.3%	2.735	15.5%	8.138	46.2%	17.621	1.14	1.51	1.78	1.36	1.36	1.521	1.769	**189**
CS87.4	Sunflower Area Freight Improvements	213-219	42.04	0.000	0.0%	0.000	0.0%	1.780	40.7%	0.570	13.0%	2.025	46.3%	4.375	1.14	1.51	1.78	1.36	1.36	1.531	1.769	**10**
CS87.5B	Slate Creek Pavement Improvements (Replace)	224-226	7.19	0.000	0.0%	0.000	0.0%	2.167	36.6%	1.290	21.8%	2.466	41.6%	5.923	1.14	1.51	1.78	1.36	1.36	1.514	1.769	**23**
CS87.6	Rye Area Safety and Freight Improvements	235-241	0.22	0.000	0.0%	0.000	0.0%	0.646	34.2%	0.725	38.4%	0.516	27.4%	1.888	1.14	1.51	1.78	1.36	1.36	1.504	1.385	**241**
CS87.7	Ox Bow Estates Area Safety Improvements	241-250	2.4	0.000	0.0%	0.000	0.0%	1.290	42.9%	1.033	34.4%	0.680	22.7%	3.003	1.14	1.51	1.78	1.36	1.36	1.540	1.615	**133**
CS87.8	Ox Bow Estates Area Freight Improvements	243-247	25.41	0.000	0.0%	0.000	0.0%	0.072	8.3%	0.555	64.0%	0.240	27.7%	0.867	1.14	1.51	1.78	1.36	1.36	1.395	1.615	**2**
CS87.9	Mazatzal Area Safety Improvements	246-251	2.28	0.000	0.0%	0.000	0.0%	5.963	77.0%	1.305	16.9%	0.472	6.1%	7.740	1.14	1.51	1.78	1.36	1.36	1.684	1.615	**225**
CS260.10A	Payson Area Safety and Freight Improvements	251-253	0.4	0.000	0.0%	0.000	0.0%	3.229	93.9%	0.121	3.5%	0.089	2.6%	3.439	1.14	1.51	1.78	1.36	1.36	1.754	0.711	**187**
CS260.10A-1 (87 Portion)	Payson Area Safety and Freight Improvements	251-253	0.4035	0.000	0.0%	0.000	0.0%	2.903	96.5%	0.072	2.4%	0.034	1.1%	3.009	1.14	1.51	1.78	1.36	1.36	1.765	0.600	**121**
CS260.10A-2 (260 Portion)	Payson Area Safety and Freight Improvements	252-253	0.4035	0.000	0.0%	0.000	0.0%	0.326	75.9%	0.049	11.3%	0.055	12.8%	0.430	1.14	1.51	1.78	1.36	1.36	1.679	1.154	**7**
CS260.10B	Payson Area Safety and Freight Improvements	251-253	13.78	0.000	0.0%	0.000	0.0%	4.711	69.8%	0.680	10.1%	1.359	20.1%	6.750	1.14	1.51	1.78	1.36	1.36	1.653	0.711	**23**
CS260.10B-1 (87 Portion)	Payson Area Safety and Freight Improvements	251-253	13.778	0.000	0.0%	0.000	0.0%	3.797	79.4%	0.388	8.1%	0.599	12.5%	4.783	1.14	1.51	1.78	1.36	1.36	1.693	0.600	**12**
CS260.10B-2 (260 Portion)	Payson Area Safety and Freight Improvements	252-253	13.778	0.000	0.0%	0.000	0.0%	0.914	46.5%	0.293	14.9%	0.760	38.6%	1.967	1.14	1.51	1.78	1.36	1.36	1.555	1.154	**2**
CS260.11	Lion Springs Area Mobility and Freight Improvements	256-260	50	0.000	0.0%	0.000	0.0%	7.619	12.3%	49.694	80.2%	4.667	7.5%	61.980	1.14	1.51	1.78	1.36	1.36	1.412	1.800	**170**
CS260.12	Christopher Creek Area Freight Improvements	260-277	6.13	0.000	0.0%	0.000	0.0%	0.375	29.1%	0.365	28.4%	0.547	42.5%	1.288	1.14	1.51	1.78	1.36	1.36	1.482	1.154	**11**
CS260.13	Mogollon Rim Area Freight Improvements	277-282	8.47	0.000	0.0%	0.000	0.0%	0.249	10.7%	1.123	48.1%	0.962	41.2%	2.333	1.14	1.51	1.78	1.36	1.36	1.405	1.200	**12**
CS260.14	Mogollon Rim Area Climbing Lane	277-280	19.07	0.000	0.0%	0.000	0.0%	0.000	0.0%	0.458	71.3%	0.184	28.7%	0.643	1.14	1.51	1.78	1.36	1.36	1.360	1.200	**1**
CS260.15	Forest Lakes Area Safety and Freight Improvements	282-304	56.48	0.000	0.0%	0.000	0.0%	14.991	43.1%	7.148	20.6%	12.625	36.3%	34.764	1.14	1.51	1.78	1.36	1.36	1.541	1.615	**130**
CS77.16A	Holbrook Area Mobility and Freight Improvements (SR 377/SR 77 connection)	386-389	92.07	0.000	0.0%	0.000	0.0%	12.601	32.3%	14.110	36.1%	12.330	31.6%	39.042	1.14	1.51	1.78	1.36	1.36	1.496	2.100	**44**
CS77.16B	Holbrook Area Mobility and Freight Improvements (US 180/SR 77 connection)	386-389	75.76	0.000	0.0%	0.000	0.0%	12.601	32.5%	13.805	35.6%	12.330	31.8%	38.736	1.14	1.51	1.78	1.36	1.36	1.497	2.100	**20**
CS77.16C	Holbrook Area Mobility and Freight Improvements (adjacent to SR 77)	386-389	46.42	4.337	2.8%	5.545	3.6%	120.564	78.1%	11.488	7.4%	12.344	8.0%	154.278	1.14	1.51	1.78	1.36	1.36	1.687	2.100	**112**